

Flipped Classroom and Measures of Engagement, Motivation, and Academic Achievement

A Collaborative Action Research Study

By

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**Approval**

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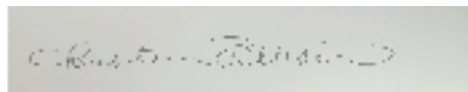
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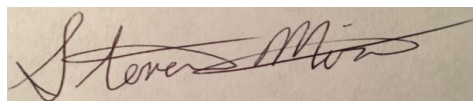
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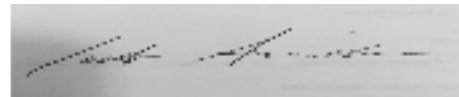
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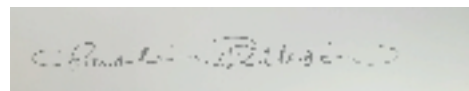
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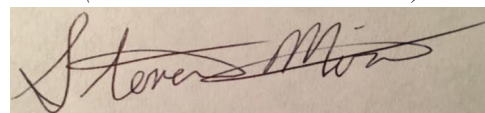
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### Abstract

The purpose of this study was to discover the effectiveness a flipped classroom approach had on academic achievement, student engagement, and motivation for math. The flipped classroom intervention study was student-centered and the role of the researchers was to facilitate the learning experience. For six weeks students participated in a flipped classroom pedagogy whereas instruction took place through videos at home and application of learned concepts took place inside the classroom compared to another mathematics course that received traditional in-class instruction. At the end of the intervention students demonstrated higher academic achievement within the flipped classroom pedagogy. Due to the scaffolding and differentiation an inverted classroom approach provide; students' motivation and engagement were increased.

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## **Chapter One**

### **Problem**

“When am I ever going to use this? Why do I have to learn this? How is this going to help me in the future? I can just look for the answer on YouTube. Isn’t there a shortcut?” All of these questions are being asked more frequently in math classes each year. If educators were to look back a few years, students would never question the math teacher as well as having the ability to look up things on YouTube because it didn’t exist. Times have changed and it can be seen with students shifting as 21st-century learners.

The lack of student engagement and motivation is a problematic trend seen throughout all grade levels. Students usually enter school with high levels of motivation, but unfortunately, students tend to lose that motivation as they progress through school (Thomas, 2015). The lack of engagement and motivation has made it difficult for many students to achieve academic success in reaching the Common Core Mathematical Standards (CCMS). The lack of engagement and motivation has especially been a challenge for English language learners (ELLs). Not only does lack of engagement in mathematics limit communities beyond the possibility to fulfill jobs that demand the ability to perform higher level mathematics, but it also limits the learner in understanding life through a mathematical perspective (as quoted in Attard, 2017).

The disparity of education is declining; it is diminishing through the underrepresented students from groups of race, ethnicity, gender, and socio-economic backgrounds. As stated in Zelkowski, et al., (2013) the integration of strategic implementation of technology within instruction promotes retention of mathematical concepts helping close the achievement gap.

In math education there has been a decrease in motivation and engagement, and its effects on academic achievement. The desired outcome of the study is to find a solution that can help the students of today who are going to be our future leaders of tomorrow. Changing how math is perceived can change mathematical performance. If students perceive themselves as being weak in mathematics, they tend not to be fully engaged in mathematical activities the way someone who believes they are strong in math would (Tsao, 2004).

The research team that worked diligently for the desired outcomes of academic growth, engagement, and motivation using the flipped classroom approach comprised of one intervention specialist and two data analysis experts. Researcher A, one of the data experts, has taught elementary school for 17 years in an urban school within San Diego County. Researcher B, the second data analyst expert, has taught elementary school for two years in a city approximately 15 miles from downtown Los Angeles. Researcher C, the intervention specialist, has taught math for four years in a city approximately eight miles from downtown Los Angeles. The researchers are interested in identifying how they could improve their own teaching methods to reach more of their students.

### **Solutions Discussed in the Literature**

The constant changes in student demographics, the economy, and internet technologies have brought great changes to the educational environment in a short amount of time. Due to these changes, educators are looking for different modalities of instruction to help students be successful graduates in today's society (Rotellar & Cain, 2013). Using technology in the classroom has not only become common practice, but it is also necessary for students to be successful 21st-century learners.

In the past few years, technology has become instrumental in addressing the problems of low motivation and confidence, as well as aiding in meeting the goals of Common Core State Standards (CCSS) and the framework for 21<sup>st</sup> Century Learning. Technology has been integrated into our everyday lives and into our students' futures. Technology is changing quickly, and students are eager to use it effectively in many different areas (school, work, social life). In fact, Kurvits and Kurvits (2013) reported that 81% of students interviewed suggested that teachers use both the Internet and information/communication technologies in the classroom.

There are many aspects of technology that make it more appealing and effective in the classroom as a tool for instruction (Sheehan & Nillas, 2010). First, technology can be much more hands-on than other methods. For example, students can create their own audio or video podcast lessons, generate 3-D graphical illustrations of calculus problems, or sketch their own geometry shapes on the computer (Bergqvist, 2012; Kaur & Wangler, 2014). Second, using technology relates to the real world. Students are inundated every day with technology in every aspect of their lives. Third, using technology can mean a welcome change of pace from traditional methods like lectures and other more teacher-centered instruction. Fourth, when students create projects or lessons using technology, they gain a sense of ownership and investment in the material (Bergqvist, 2012). Lastly, using technology in the classroom reflects a more student-centered approach as it requires students to be more active learners. This has been termed a constructivist approach, as opposed to a traditional approach (Kurvits & Kurvits, 2013).

### **Study Participants**

The study targets two classes comprised of 64 high school students, grades 10 through 12 each in an Algebra II course at a Title 1 School in Southern California. The school is located eight miles east of Los Angeles. The high school contains ethnic groups that are predominantly Asian and Hispanic/Latino. There are 1,905 students who are qualified for free or reduced lunch. The school site is also undergoing a four-year improvement program as a result of not producing the Adequate Yearly Progress (AYP) requirements (California Department of Education, 2016).

There are 31 students in the control class receiving the direct traditional approach of instruction. The control group contains 17 females and 14 males: 22 students are Hispanic, 4 are Caucasian, and 5 are Asian. The focus group contains 33 students: 20 females and 13 males. 20 students are Hispanic, 4 are Caucasian, and 9 are Asian. The focus group will receive an inverted classroom approach, which is called “the flipped classroom” pedagogy. A flipped classroom is an educational approach comprised of short videos and lectures viewed by the students at home, allowing class time to be spent on discussions, projects, and other activities (Lane-Kelso, 2015).

### **Purpose of the Study**

The purpose of this study was to determine the impact that the flipped classroom approach had on academic performance, engagement, and student motivation for math. By using the flipped classroom approach, teachers are no longer the center of learning; their job is to facilitate the learning taking place in the classroom. In this new era of Common Core Implementation (CCSS), it is essential that instructors provide their students the tools needed to think critically, as they will be expected to do this on a regular basis in other classes and in their future careers. Utilizing the flipped classroom approach helped demonstrate for students various

methods of utilizing technology responsibly. In addition, it was used as a support for shifting from a traditional way of instruction, to a more enhanced experience that tailors to the tools of the 21st century and learners by scaffolding strategies to assist individual students' needs, allowing more in class availability for application of subject matter.

The outcomes desired of the study was to see an increase in student academic achievement, engagement, and motivation as observed through the study of the participants whom will be part of a flipped classroom methodology. Currently, 45% of students at the study site are proficient in math as a district average. The action research study was focused on high school students from 10th -12th grades from a high school within a suburban area in Los Angeles County. The intervention specialist researched the benefits of having a flipped classroom compared to a traditional mathematics classroom.

These reflections have resulted in the following research questions:

1. Primary question: What impact would a flipped classroom approach have on academic achievement compared to a traditional approach in high school mathematics as measured by surveys, assessments, observations, and class participation?
2. Secondary question: In what ways do high school students' perceptions on motivation and engagement differ between a flipped classroom and traditional classroom approach?

### **Definitions of Terms**

**Common Core Standards for Mathematical Practice:** Varieties of expertise that mathematics educators at all levels should seek to develop in their students (National Governors Association, 2010).

**Common Core State Standards (CCSS):** Nation-wide educational standards designed to provide a consistent and clear understanding of what students are expected to learn for success in college and careers in the relevant world (National Governors Association, 2010).

**Flipped Classroom:** An inverted technological methodology of instruction in which direct instruction is assigned for homework and collaborative applications of concepts occur in class (Lane-Kelso, 2015).

**Framework for 21<sup>st</sup> Century Learning:** A set of teaching and learning goals to enable students to be successful in the current global economy (Partnership for 21st Century Skills, 2011).

**Technological Pedagogical Content Knowledge (TPACK):** An academic infrastructure for educators' understanding of content and how to successfully integrate technology for effective instruction and comprehension (Zelkowski et al., 2013).

**Constructivist approach:** A teaching strategy in which students are expected to be creative problem-solvers (Kurvits & Kurvits, 2013).

**Student-Centered:** Teaching strategies targeted at making the students active participants in their learning (Jones, 2007).

**Teacher-Centered:** Teaching strategies in which the teacher leads the learning, students are passive learners, and the lessons are traditionally more lecture-based (Kurvits & Kurvits, 2013).

**Podcast:** An audio or video recording, often part of a series that users subscribe to using the Internet.

**Conclusion**

Educators in the 21st century are attempting to help their students meet the expectations of Common Core. One means of achieving this is effectively exposing students to technology by integrating it into the teaching materials. As mentioned in Chapter 1, the problem of declined academics, engagement, and motivation will guide the research using a flipped classroom technological pedagogy which will be further discussed in the next chapter.

The intervention will be comparing a flipped classroom approach to a traditional classroom approach. For about four to six weeks the focus group will be taught using a flipped classroom approach where students have to watch the lesson(s) assigned by the teacher and come prepared to work in groups, participate, present problems to their classmates, and have an exit ticket. In a flipped classroom, the teacher has more time to cover more topics and give assistance to the lower achieving students (Bhagat, Cheng-Nan, & Chun Yen, 2016). In the traditional setting, the teacher will be teaching the concepts the day of and have guided practice problems within the lesson as well as an exit ticket. Chapter Two will explore the literature related to technology and learning, and specifically the flipped classroom.

## **Chapter Two**

### **Review of Literature**

#### **Flipped Classroom Approach**

While in the 21st century there are emerging technology and contemporary trends in education; each method of teaching assists with the demands of our 21st-century learners. More emphasis on technological resources is seen with hopes to motivate, engage, and obtain academic achievement. One of the many pedagogical approaches is the flipped classroom approach, also known as an inverted classroom. Mazur and Jacobsen (2015) best describe the instruction as switching or flipping the way the content of the lesson is usually delivered in class to assigned videos as homework so outside of class and the application of these learned concepts within the normal scheduled class time. Also known as reversing lessons through flexible timings; content delivery is made available through videos on the computer at home rather than in class (Lane-Kelso, 2015).

Students in the United States continually score lower than the rest of the world in international mathematics assessments. According to Schmidt (2012), student performance on mathematics assessments in the United States was simply mediocre to extremely poor, depending on the grade level and test. In the 2011 Trends in International Mathematics and Science Study (TIMSS) 8<sup>th</sup> grade mathematics report, the United States finished in ninth place only nine points above the international average (National Center for Education Statistics, 2012). Another report from the United States Department of Education showed that American middle and high school students fell behind teenagers in other industrialized countries in mathematics performance. The United States students finished in the bottom 25% percent of all countries that



participated in this study (State Educational Technology Directors Association, 2011). Furthermore, students were found to be extremely behind in mathematical literacy and specifically the ability to apply mathematics according to the Program for International Student Assessment (National Council of Teachers of Mathematics [NCTM], 2009). Numerous attempts at reforming education in this country over the last 30 years have proven unsuccessful (Edwards, 2011).

A probable cause of our country's poor achievement in mathematics can be linked to passive learning experiences that students received in classrooms across America (Weiss & Pasley, 2004). Passive learning has negatively affected knowledge acquisition and comprehension, especially among average students. However, when average students were engaged actively in the classroom, the results were extremely positive (Gonder, 1991). Loch, Galligan, Hobohm, & McDonald (2011) found that active learning improved student achievement is aggressively shifting away from the traditional learning environment because it is losing ground on nurturing the minds of the future. Low test scores combined with a lack of motivation in the classroom are two factors teachers must address to prepare students for the skills of tomorrow. Teachers are teaching the same materials and techniques that were taught years ago when technology was non-existent.

### **Socratic Model**

There are feelings of apprehensiveness displayed by students that when transitioning into a flipped classroom approach, it derives from limitations on Socratic teaching. These limitations can be described according to Westermann (2014) as losing the captivating face-to-face value of asking and answering dialogue. Socratic methodology serves to create dialogue as means of

instruction whereas students learn through collaborating with one another. While a flipped classroom approach may be seen to underestimate Socratic approach of direct instruction in class, Schaffzin (2016) states, “flipped learning is simply the Socratic Method in new packaging” (Schaffzin, 2016, p. 676). Socratic model of engagement and collaboration is built by enriched dialogue whereas students have some knowledge beforehand in order to discuss the content. Nonetheless, it’s a form of engagement is the face to face collaboration done within the class time. Where the role of the teacher is to observe, offer feedback, and assess. A flipped classroom support socratic methodology by allowing students to review the lessons at home for homework and coming to class prepared with the material to begin a dialogue with prior knowledge on the content area being discussed (Schaffzin, 2016 ).

### **Collaboration and the Flipped Classroom**

An inverted style approach of teaching focuses on enhancing the collaboration from the applied instruction assigned prior to class time. The collaboration is focused on inquiry-based guided questions. This leads to motivated and engaged students through participation in discussions. The students are able to grasp different opinions about subject matter (Mazur & Jacobsen, 2015). “A very social interactive classroom discussion,” as Crews and Butterfield would call it (2014, p. 44).

In a flipped classroom students working in groups are able to communicate with one another and support the learning through provided class time for guided collaboration (Mazur & Jacobsen, 2015). This pedagogical method of constructivism in the flipped classroom approach is designed solely for the purpose of active learning which is student-centered with a focus on collaboration and reinforcement of the assigned content (Westermann, 2014) motivated through

student-directed inquiry-based learning (Lane -Kelso, 2015).

### **Technological Pedagogical Content Knowledge**

As the deliberate emphasis on exposure to technology is implemented for student engagement, it is also used to preview instruction outside of the classroom (Mazur & Jacobsen, 2015). Technology is considered a guide towards the application of concepts (Lane -Kelso, 2015), through many various activities to assist in problem-solving through forms of collaborative deliberations and debates (Westermann, 2014).

As Zelkowski et al., (2013) embark on the growing needs of accessible technology for students in grades K-12, The Technological Pedagogical Content Knowledge (TPACK) frameworks were created and revised to implement technological tools within teaching and learning. More specifically, an acquired knowledge is needed to efficiently support the integration of technology through a framework of technological, pedagogical, and content knowledge, also known as TPACK (Zelkowski et al., 2013). The emphasis on the implementation of content knowledge using technical tools can be seen in the flipped classroom approach. Specifically, in the subject matter of mathematics, TPACK is implemented using the following essential components:

1. Design and develop technology-enhanced mathematics learning environments and experiences.
2. Facilitate mathematics instruction with technology as an integrated tool
3. Assess and evaluate technology-enriched mathematics teaching and learning
4. Engage in ongoing professional development to enhance TPACK (p. 177)

The emphasis on the implementation of content knowledge using the technical tools of

TPACK can be seen demonstrated in the flipped classroom approach supporting a cohesive learning environment that is student centered.

### **The Impact of Technology in the Classroom**

Students' struggle with mathematics has been a continuum with teachers trying to find new strategies to engage our 21st-century learners. In many of the secondary classrooms across the country, students are passively engaged in the mathematics content, and academic achievement can be described, at best, as mediocre (Clark, 2015). The United States Department of Education further acknowledged that American teenagers are trailing behind their counterparts in other industrialized countries in their academic performance, especially in mathematics (State Educational Technology Directors Association, 2011).

Implementing technology effectively has proven to improve student achievement by changing a traditional approach of teaching towards a student-centered teaching strategy using a flipped classroom approach. Several studies have revealed that this learning mode can improve students' learning achievement and increase the interaction among peers and teachers (Schultz, Duffield, Rasmussen, & Wageman, 2014). Students today are surrounded by technology whether it involves social media, smart phones, Ipads, and many more. As teachers, it is important to realize that rather than being the gatekeeper of information, there needs to be access to technology and directions on how to use the technology to help our students be self-sufficient learners. Technology can shift student learning from a passive activity to an active one. Technology can also help prepare students for the future jobs of the 21st century workplace (Watters, 2014).

Technology is prevalent in education and society, and educators have an opportunity to

enhance academic performance with newer tech based methods like the flipped classroom. This realization has led many teachers to reflect on educational pedagogy and to try new methods that are more relevant and engaging to today's students (Prensky, 2010; Kelly, 2007). In order to reach all children in the United States and prepare them to be 21st-century learners, teachers must move past the traditional types of instruction and embrace the widespread technology that exists around them (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011). There is currently a disconnect between real life technology and its application into the classroom. Part of the challenge in education today is placing technology into the classroom and using it properly to enhance tomorrow's needs. Instances like so, has helped develop the need for TPACK as it creates a framework for implementation of technology purposefully to maximize the learning within the classroom. Nonetheless, the expectation of technology implementation is quickly increasing within mathematical applications (Zelkowski, et al., 2013).

### **Positive Effects of Technology**

National Council of Teachers Mathematics (NCTM) statutes the following "Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning," (NCTM, 2000, p. 24). In recent years, technology has been considered extremely valuable for enhancing the quality of learning and teaching (Tzu Chien, 2007). There are several positive uses of technology in today's mathematics classrooms. This technology includes but is not limited to chrome carts, iPad, smart phone with apps, desmos.com, Socrative, graphing calculators, and much more.

Qing and Xin (2010) found that the best use of technology in schools was dependent on sound teachers who had an understanding of the effects of technology in classrooms. Simply

using technology and expecting results did not work. The incorporation of technology can engage students in a way previously unseen and connect them to the real world. Technology has a unique benefit in that it moves the classroom environment from teacher-centered to student-centered. This is a positive direction since it changes learning from a static one in which students simply receive data to one in which students actively participate in their own learning (Sabzian et al., 2013). Meaningful learning is more likely to occur when students use technology to conduct problem-based projects, present, and build information in different multimedia ways, and search the Internet to come up with answers to various questions in class.

Similarly, surveyed students in a classroom with laptops reported positive attitudes towards the laptops. These students found that the learning environment was more enjoyable and showed an increase in motivation. As a bonus, students in this classroom with laptops frequently went above and beyond the basic requirements set up by their instructor in different projects (Sabzian, Gilakjani, & Sodouri, 2013).

Beldarrain (2006) found that another positive effect of using technology in education was an increase in collaboration in the classroom between teachers and students. What started in the beginning of the Internet as email, chat rooms, and discussion boards, online collaboration has expanded to include many more tools (Beldarrain, 2006). Blogs, wiki-pages, and podcasts have all changed the way students can collaborate with each other and with teachers (Beldarrain, 2006). These tools enabled both individual and group-based learning to occur.

### **Negative Effects of Technology**

Although technology, used to its fullest potential, can be a powerful tool for teaching and learning, researchers have found several different ways that technology inhibits learning. First,

since many schools have often introduced technology into the educational process in a non-organized fashion, this proved to be a hindrance rather than an asset (Shapley et al., 2011). Other researchers have found little evidence that this approach improved learning, despite the large amounts of money that have been invested (Richtel, 2011). There is no doubt that technological skills are necessary for success in the 21<sup>st</sup> century workplace. With that said, there have been some within the educational technology world who were unsure if the high price of technology in the classroom was effective when compared to the relative success of the students using such tools (Louv, 2012).

A case study of more than 150,000 junior high school students in North Carolina from 2010 found another negative impact of technology on education. Students who were given a computer midway through the study had a substantial decrease in their grades. The researchers concluded that the decrease in grades was due to the computer distracting the students, a problem also found in students' day-to-day life (Krueger, 2013). Students were not only using computers in class to accomplish on-task assignments but also using the computers as toys to chat with friends and write emails. Studies have revealed that most students utilized technological devices for activities completely unrelated to formal learning (Tzu Chien, 2007).

Many people consider using technology in a mathematics class to have a negative effect on student learning. Basic four-function calculators, for instance, required users to have a rudimentary knowledge of math. Quinn (2009) argued that using calculators inhibited children from developing the capacity to reason abstractly. Some also argued that the time spent learning technology required to solve mathematical problems, including advanced mathematical software, took time away from solving math problems themselves. Time is in short supply in schools so

any time taken away from the problems themselves is to the detriment of the student (Risser, 2011).

### **The Impact of a Flipped Classroom**

#### **Benefits of a Flipped Classroom Approach**

While a flipped classroom is used for a direct orientation of target concepts assigned for homework, its purpose is to enforce the most crucial segment of application within the classroom. This utilizes time more efficiently within the guided class time frame for support (Lane -Kelso, 2015). Mazur and Jacobsen (2015) state, some student responses to a flipped style approach limit the availability to pose questions during a lesson when watching the assigned video outside of the classroom. Consequently, Kirvan et al., (2015) mention a decrease in student questions when viewing the short four to six-minute instructional videos. Westermann (2014) argues its focus is to expose content prior to in-class lectures to challenge and foster application of instruction from revised Bloom's Taxonomy model of levels of cognition.

By using instructional videos, teachers can expose students to new ideas before class, allowing class time to be spent on group learning activities, discussions and solving problems with the support of their learning community (Lo & Hew, 2017). Educators have taken advantage of the flipped classroom in various ways. For example, art teachers might have students view a video on sculpting and then have students spend the class time sculpting. A physical education teacher might provide a video for students to watch at home on how to perform certain movements and then spend class time practicing the movements (Bergman & Sams, 2014).

Since a flipped classroom approach requires that students be prepared by having



examined the material prior to attending class, it allows students more ownership in planning their learning and more time for in class interactions with their classmates (Lo & Hew, 2017). In one study, students asked more questions in the classroom after they viewed a video and failed to understand the material that they viewed at home (Cakiroglu & Ozturk, 2017). This model also allows for more teacher-student one on one time with more flexibility for individual scaffolding (Kostaris, Sergis, Sampson, Gianakos & Pelliccione, 2017). With a flipped classroom, teachers do not have to spend all their time in the front of the class talking at students. Instead, they can spend their time interacting with the students. An added benefit to this, teachers get to know the students and are able to respond not only to their academic needs but also to their emotional needs, which is especially important for at-risk students (Goodwin & Miller, 2013).

When high school students miss class due to extracurricular activities, the material missed can be accessible to them via the videos provided by the teacher (Bergmann & Sams, 2014). If students struggle with the lesson in class, they can always go back and review the material on line to clarify any misconceptions (Goodwin & Miller, 2013).

Flipped classrooms allow time for students to be engaged in learning based on their needs. Some technology also allows for teachers to give students choices in their learning. Learning can take place beyond the classroom and become more personalized by allowing students' choices and access to their material at any time and any place (Sams & Aglio, 2017). Today's students who are used to reaching out to technology and the Internet for information, are more likely to find information presented in this way more engaging. Furthermore, research shows that learners tend to check out after ten minutes of being exposed to new material. Using short lectures online, allows learning to be broken down into shorter more engaging and

manageable episodes (Goodwin & Miller, 2013).

In a traditional classroom, the pacing in which information is shared in a lecture might not be beneficial to all students since for some, the pacing might be too slow and repetitive and for others it might be too fast and lack the prior knowledge necessary to make sense of the learning (Goodwin & Miller, 2013). The flipped classroom helps meet the needs of diverse learners. For example, if a student is struggling and does not quickly grasp the information presented in the video, he can simply, pause the video and review the information. Comparatively, advanced students can keep from wasting time by skipping parts of the video that they are already familiar or proficient with (Lo & Hew, 2017). According to Kostaris et al., (2017) this model is especially beneficial for low-performing students because it allows for students to receive immediate feedback and support from their teacher and classmates.

For struggling students, in a non-flipped classroom, the traditional take home part of the homework is often done in isolation and frustration (Goodwin & Miller, 2013). A way to encourage active engagement is for teachers to give students choices, approved by the teacher, in how they can learn and practice the material (Sams & Aglio, 2017). Materials available for students to view in the home portion of the flipped classroom do not have to be limited to videos, they can also include tools including graphs or photographs (Goodwin & Miller, 2013).

Rather than utilizing valuable class time to incorporate traditional direct instruction, which is the lower level of cognitive work, lessons are assigned to be done at home to bring forth a prior knowledge and assimilation of new key concepts further developed during class time. An educational reformer, John Dewey, supported the notion of application of “learning by doing,” as it supports a student-centered approach and incorporates differentiated instruction

(Lane-Kelso, 2015, p. 144). This reinforces the notion of authenticity by using the flipped classroom approach as a means of individualized instruction whereas John Dewey regards as scaffolding ways to show competence (Lane -Kelso, 2015).

### **Support for Diverse Learners**

It is now the norm that in various urban cities, schools are becoming multicultural as well as multilingual. Therefore, it is important that schools provide educational opportunities for all their learners, including learners with limited language skills. Unfortunately, it is common in many countries for immigrant students to fall behind in basic mathematics (Takeuchi, 2015). One of the common challenges in language instruction is the lack of individualized instruction. The flipped classroom allows for discussion posts where students can practice material such as grammar, the material being available for easy review and for the availability of quick feedback from the instructor (Webb and Doman, 2016).

The flipped classroom is handy because it allows for the possibility of various learning tools and resources that can be accessed in and out of the classroom that can help address the mixed language abilities, learning goals and learning styles that often cannot be addressed in the classroom (Webb & Doman, 2016). In a study from 2012-2013 second language learners who participated in a flipped classroom reported benefits that included being able to advance at their own pace, increased time to participate in the classroom, being able to review the material as needed and the flexibility in how class time is utilized (Basal, 2015). In another study, students in a flipped classroom reported feeling more confident in their English grammar skills than in a regular classroom (Webb & Doman, 2016). A flipped classroom allows for second language learners to have a language model other than the teacher, by allowing for students to view videos

of real life situations narrated by native speakers. A flipped classroom also allows for students to include material that is of high interest to the learners (Basal, 2015).

### **Challenges to a Flipped Classroom**

A flipped classroom approach encourages the use of technology and to support its use of educating 21st learners. Feedback from a study that utilized the inverted classroom environment cautioned, warned, and complained, that instructors implementing the idea of flipped classroom should regard the limited access to the Internet at home, along with immense exposure to a flipped classroom (Lane-Kelso, 2015). Students who do not have access to Internet or consistent internet connection at home may be challenged to view the assigned instruction.

Creating a flipped classroom requires that the teacher not only be technologically skilled, but also be willing to invest much time in preparing the classroom, as well as training the students in the expectations of a flipped classroom model. It is equally important that time be spent in training the parents in the expectations of a flipped classroom and how a flipped classroom works (Aidinopoulou & Sampson, 2017). When first being exposed to a flipped classroom, students may be resistant because it requires students to be exposed to new material independently at home instead of at school (Herreid & Schiller, 2013). A problem some teachers face is students being unprepared for class due to a lack of commitment outside of classroom and teachers being able to hold them accountable (Lo & Hew, 2017). Another challenge that arises with many teachers, is how to use technology effectively so that our students are walking away with skills that they can build on for their future success. The expectations for “coming to class prepared to learn” will require more from students than simply coming to school on time prepared to participate in taking notes (Rotellar & Cain, 2016).

An issue that teachers complained about in one study was not being able to find good quality videos that supported the material being taught. Often teachers have to use videos produced by programs such as Khan Academy or they have to create their own videos and then post them on YouTube. Creating these videos requires a lot of time on the teacher's part and often the quality is not great (Herreid & Schiller, 2013). Teachers also have to be willing to surrender the role of the giver of knowledge and instead see themselves as a guide in the classroom and focus on their value to the classroom and the ability to meet students needs (Rotellar & Cain, 2016).

Mazur and Jacobsen (2015) pose a solution to the challenges students have which is no internet access, and instead allows time and resources after regular in-class assignments are finished. Also, by providing internet access before or after school, such as in a computer lab allows for available completion of flipped classroom assignments. Also to not overwhelm students with difficult concepts, lessons can be divided into sections for more efficient management of understanding of concepts, also known as chunking.

### **Flipped Classroom and Common Core Math Standards**

As new methodology of teaching and tools emerged in the 21st-century, along with the adoption of new standards including the Common Core State Standards (CCSS), a framework of math standards with the expectation of teaching with embedded technology to enhance the lesson emerged (Zelkowski et al., 2013). As recognized by Zelkowski et al. (2013), the foundational component of technology and its strategic usage of educating and understanding is a framework supported by the flipped classroom.

As TPACK is seen as an educator's ability to implement purposeful technology into

instruction, the Common Core State Standards (CCSS) can be seen integrating technology as a standard. Students being able to utilize technology within the 21st-century allows them to also learn content from the resources as well (Jacobson-Lundeberg, 2016). The collaborative piece within the classroom comprised of small group collaboration can support the literacy expectations with speaking and listening included (Jacobson-Lundeberg, 2016).

Kirvan et al., (2015) described a flipped classroom as a balanced model of both conceptual and procedural understanding of mathematics in which mathematics are expected to be taught from the CCSS. The CCSS require focus on numerical reasoning and mental math skills (Burns, 2013). While both Burns (2013), Wurman, and Wilson (2012) argue arithmetic is the foundation and a priority of teaching mathematics; elementary schools are instead focusing more on geometry, memorization, and recitation of math fact fluencies. For example, as students are expected to be able to recall multiplication facts, there is a decrease in the conceptual deeper understanding of developing basic number sense. More attention of understanding how numbers are related through basic algorithms is needed (Wurman & Wilson, 2012). Although the prioritization of arithmetic is hindered within the earlier grades, CCSS carefully and strategically ensures implementation of applications within the later grades in high school curricula to arithmetic.

To support the common core's mission to obtain career and college readiness, three years of mathematics is required in high school for Algebra I, Algebra II, and Geometry. Despite CCSS potential limitations on clarity and rigor, these can be reinforced through the implementation of a flipped classroom approach, known as differentiated learning and scaffolding approaches for individualized instruction (Wurman & Wilson, 2012). The flipped

classroom supports common core math standards through conceptual understanding. Through assigning videos that focus on procedure-based instruction at home, it helps to focus on the actual application of the mathematical concepts. The class time allotted to build upon the understanding of the concepts help build connections in class to real life problems. These connections provide a relational application of math standards engaging students to perform and apply new skill sets learned from assigned videos before class (Kirvan et al., 2015). The standards practiced can be evident within the class time for application in the flipped class pedagogy (Burns, 2013).

### **Rationality of Implementing a Flipped Classroom Pedagogy**

Students today demonstrate a decreased preference for lecture-style instruction (Roehl et al., 2013). The flipped classroom approach has gained a lot of steam in educational circles as a means to turn in-class time from passive to active learning (Roehl et al., 2013). Researchers who have implemented the flipped classroom approach found that real-life application was brought back into the classroom, student interest and motivation increased, and instruction aligned with CCSS to prepare students for the 21<sup>st</sup> century global environment. Once students are interested, learning is once again meaningful. The flipped classroom approach incorporates the four key components of 21<sup>st</sup> century learning: collaboration, communication, critical thinking, and technology (English & Kitsantas, 2013; Larmer & Mergendoller, 2010; Partnership for 21st Century Skills, 2011). If done properly, students can have more time to persevere and learn beyond the textbook; there is more time in the classroom to discuss and cover topics with a deeper understanding.

Students often view mathematics as a series of unrelated procedures and techniques that

have to be committed to memory. Swan (2005) found that rote memorization did not work because math is a series of building blocks that require understanding and application to move on to the next level. Students should engage in discussing and explaining ideas, creating and solving each other's questions and working collaboratively to share methods and results (Swan, 2005). Whenever issues arise that they cannot understand, students need to utilize other students and technology to seek answers. With technology now readily available, the teacher is not the only source of answers. Students can now utilize online resources and get answers/explanations until they are fully satisfied.

While the flipped classroom approach typically becomes synonymous with students watching videos at home, this is far from the most important aspect of this shift in educational pedagogy. Siegle (2014) concluded that the best way to ensure a successful flipped classroom was increasing active learning experiences at home and at school. The biggest change in the flipped classroom approach was felt in class. Students used this time to work on problems, collaborate with classmates, and advance concepts (Roehl et al., 2013). Another change came when it was time to practice and explore mathematics more deeply. Students no longer worked on their homework in solitude. The flipped classroom approach allowed for teacher and peer support when necessary in working through problems (Flumerfelt & Green, 2013).

### **Justification for Integrating the Flipped Classroom**

There have been several studies describing positive results of using a flipped classroom approach. Roehl et al. (2013) found that students became more aware of their own learning process because they became active participants in a student-centered classroom. Flumerfelt & Green (2013) found that academic assessments of students using a flipped classroom approach



showed higher scores in several categories than those in a control group. Another study found that 80% of students had an improved attitude toward school due to a flipped classroom approach.

It was not only students who had an improved attitude; 88% of teachers indicated that their job satisfaction improved when they began to implement the flipped classroom approach (Flipped Learning Network, 2012). Additionally, students in one study reported that they liked a flipped classroom approach more, that they learned more than in traditional in-class lecture formats (Herreid & Schiller, 2013), and they felt more in control (Flumerfelt & Green, 2013).

### **Considerations for Implementing the Flipped Classroom**

Teachers should attend to the following important implementation issues surrounding a flipped classroom approach. One key consideration is that teachers should allow plenty of time for students to reflect on their learning and on the process, which helps them to make connections to the content (Roehl et al., 2013). In addition, teachers need to encourage students to interact with the content using their own learning style (Roehl et al., 2013). The expectations should be made clear verbally and in the syllabus, regarding the level of personal responsibility required of the students (Roehl et al., 2013). Another important point is to keep the videos at an appropriate length; students may disengage if the videos are too long (Gaughan, 2014). Finally, teachers can check that the students watched the videos via quizzes, or by requiring students to come to class with a question only obtainable by watching the video (Bergmann & Sams, 2012; Herreid & Schiller, 2013; Roehl et al., 2013; Tucker, 2012).

### **Potential Barriers and Limitations**

Technology integration has been a topic of discussion among educators for over thirty

years (Lowther, Strahl, Inan, & Ross, 2008). Thousands of articles have been published recommending strategies to integrate technology to support a student-centered and student-directed curriculum. However, many classrooms are still using teacher-centered learning instead of student-centered and are not utilizing technology (Lowther, Strahl, Inan, & Ross, 2008). As technology progresses, it is logical that technology would be the key to students' future success, yet schools are slow to catch up with students' needs.

Unfortunately, there are often barriers to the technology integration, such as resources (both hardware and software), training, and support. Financial barriers may exist on the part of school districts, schools, teachers, and families, thus limiting access to computers and the Internet (Roehl et al., 2013; Hew & Brush, 2007). It is unfortunate, but not all districts/schools are created equal. Due to limited financial funding to provide technology like computer labs (Rogers, 2000), not all schools are 100% digital. Those fortunate enough to be 100% digital are taking advantage of the available resources to bring 21<sup>st</sup> century education into the classroom.

In addition to these more general barriers to implementing technology in the classroom, there are several potential barriers and limitations to the flipped classroom approach, some from the student's perspective, and some from the teacher's. First, some students might prefer traditional methods. They may not like working in groups or watching videos, etc. (Roehl et al., 2013; Herreid & Schiller, 2013). A related teaching strategy that addresses this issue is blended learning, in which students can watch the videos at school so they can ask questions immediately (Smith & Suzuki, 2014). Secondly, a common concern students have had is they do not necessarily have the technology available at home due to financial limitations. A final student-related obstacle is that students have to take more responsibility for their learning (Roehl

et al., 2013; Herreid & Schiller, 2013).

Furthermore, for the flipped classroom approach to work, students need to be motivated to complete home assignments. These home assignments are not always simply to watch a video online. Sometimes, the home assignment might be to explore a website or observe a presentation on the topic from someone other than the teacher (Siegle, 2014). Students need to be responsible enough to watch the videos independently. Students who are not motivated to complete the at-home assignments risk falling further behind peers and cause more challenges for teachers during class time. To address this concern, teachers may need to use technology tools to monitor and keep track of who is watching the videos (Herreid & Schiller, 2013). Some teachers have required students to complete online quizzes or answer questions after coming to school; questions that students could only answer if they had viewed the video or explored the website (Herreid & Schiller, 2013).

Though the students are responsible for watching the flipped videos before entering the class, teachers still play a major role in guiding their questions and ideas. The teacher needs to be a facilitator in the classroom during the majority of the class so students can have meaningful discussions, leading to deeper understanding and critical thinking (Bergmann & Sams, 2012; Flumerfelt & Green, 2013).

To help transition teachers and overcome some of these barriers, professional development (PD) could also use the flipped classroom model (Bergmann & Sams, 2012). For example, teachers could review the resources about the topic at hand on their own time before group workshops. Teachers often feel that administrators forget about using novel teaching and learning strategies when planning PD. Flipped PD gives teachers control over how they learn,

just like students in any class. If the teachers are comfortable enough to learn technology, they can certainly bring that into the classroom (Bergmann & Sams, 2012).

### **Conclusion**

Students deserve to have the best learning experiences and possibilities available to them. Using a flipped classroom opens up the classroom to different possibilities that can help engage many different learners. Educational environmental factors, such as class size and resources available may vary widely and affect the learning outcomes, however, as with any new teaching approach, the way it is implemented and executed are crucial for its long-term success (Roteller & Cain, 2016).

Using a flipped classroom may look different than a traditional classroom, where students usually learn the material from a teacher led lecture, possibly followed by an activity, which is, likely also led by the teacher (Lo & Hew, 2017). However, a flipped classroom does not mean less of a commitment from teachers. On the contrary, a flipped classroom might require more interaction, guidance, and communication with the students (Roteller & Cain, 2016). So as to be effective, a flipped classroom should be designed based on the needs of the students (Lo & Hew, 2017). Chapter 2 reviewed the literature connected to the impact of a flipped classroom pedagogy. Chapter 3 will present the flipped classroom intervention which supports the technological pedagogy of content knowledge (TPACK) within the common core state standards of an Algebra II class with high school students in grades 10th - 12th.

## **Chapter Three**

### **Methods**

The purpose of this chapter is to explain the setting, methodology according to which intervention was implemented and the roles of the researchers. This chapter explains the implementation and data collection procedures of using a flipped classroom approach.

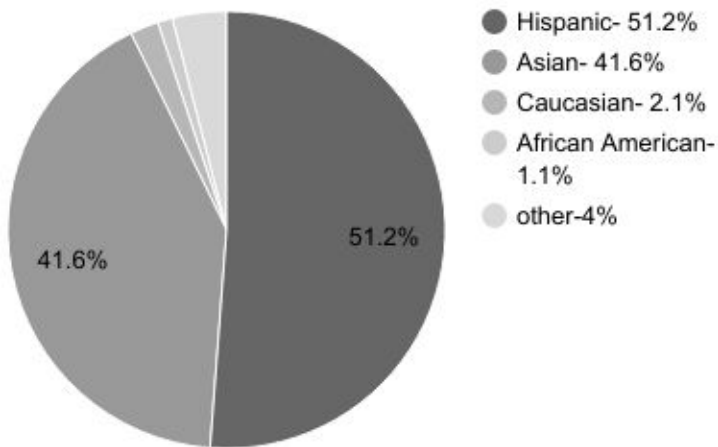
#### **Setting**

This research study was conducted at a school site in Los Angeles County. The Intervention Specialist implemented the intervention in a high school setting. The research took place at the Intervention Specialist's site. The high school is about eight miles east from Los Angeles. The two major ethnic groups at the site of intervention are Asian and Hispanic/Latino. In 2016, the city in which this high school is located had a population of 85,551 people. As of 2016, the two largest ethnic groups were Asian at 52.6% and Hispanic/Latino at 41.4%. Within the population, 40.7% of individuals are homeowners with the median housing value at \$494,500. The median household income is \$53,582 and 15.8% of the population was below the poverty level. 80.7% of the population are high school graduates and 32.8% have a bachelor's degree or higher (United States Census Bureau, 2016).

The research site is a Title 1 school in Southern California near Los Angeles. The school is located across the public library, city hall, and the police department. The school's mission is focused on helping students become motivated and self-directed learners, organized and critical thinkers, responsible and respectful citizens, and self-disciplined individuals (Ed-Data, 2016). At the time of this study, there was a total of 2,642 students enrolled at the high school. The

school's student population consists of 51.2% Hispanic or Latino, 41.6% are Asian, 2.1% are Caucasian, 1.1 % are African-American, 4% are others (see Figure 1). Of the total student population, 1,905 students qualify for free and reduced lunch, 1,953 are socioeconomically disadvantaged, 436 are English Language Learners, and 1,113 are Fluent English Proficient students. This school year 2016-2017, the high school is under year four of program improvement for failing to meet specific Adequate Yearly Progress (AYP) requirements (California Department of Education, 2016).

Site Enrollment by Race/Ethnicity (n=2642)



*Figure 1.* Site Enrollment by Race/Ethnicity (n=2642).

According to the Department of Education (2016), in the school year 2015-2016, the total expenditures per student were \$8,826. The high school is led by one principal and five assistant principals who oversee the Offices of Instruction, School Counseling, Business and Activities, and Student Employee Welfare. The average class size for the high school during the 2015-2016 academic year was 33 students and the school had 105 fully credential teachers. In 2015-2016, there were six academic counselors, one social/behavioral counselor, one librarian, one nurse, and two speech pathologists (Alhambra Unified School District, n.d., p. 4).

For the 2016-2017 academic school year, the Intervention Specialist taught five periods of math instruction and had an additional period dedicated as a conference period. The Intervention Specialist taught two periods of Integrated Math II, two periods of Algebra II, and one period of Integrated Math III. Out of the five classes that the Intervention Specialist teaches, three are collaboration classes which place students with disabilities into mainstream classes.

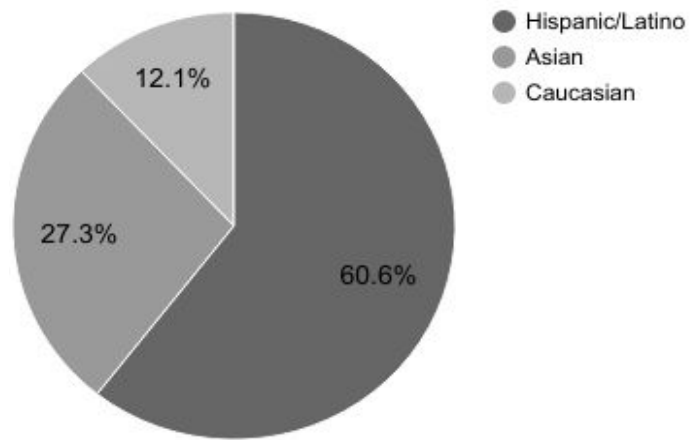
### **Participants**

The Intervention Specialist conducted the intervention in an Algebra II class consisting of 33 students in grades 10 through 12, with 1 Sophomore, 21 Juniors, and 11 Seniors; 20 of the students were female and 13 were male. This class contained 33 students, of which 20 are Hispanic/Latino, nine are Asian, and four are Caucasian (see Figure 2). The achievement level of the Algebra II class for the first semester was the following: nine students earned an A, three students earned a B, eight students earned a C, seven students earned a D, and six students earned an F. These results translate to the following: 39% of the students were below proficient in the Algebra II class, 34% of students are proficient, and 27% of students are above proficient. These results are slightly better than the overall achievement level of Intervention Specialist



school site's where 58% of the students are below proficient, 22% of students are proficient, and 20% of students are above proficient (Ed-Data, 2016). The motivation level for the students in the Algebra II class was above average where 70% of students turn in homework, 20% of students attend after school tutoring, and 95% of students turn in their notebooks.

## Intervention Specialist's Class Demographics



*Figure 2.* Intervention Specialist's class by ethnicity and race.

**Role(s) of the Researcher(s)**

The Intervention Specialist implemented the intervention of a flipped classroom and was responsible for collecting all the data. The Intervention Specialist taught for four years at a high school in a school district in Southern California near Los Angeles. The Intervention Specialist has taught Algebra I and II, Geometry, Trigonometry/Pre-Calculus, and Integrated Math I, II, and III. The Intervention Specialist's role was to make sure that the intervention went as smoothly as possible and that all participants felt comfortable and safe throughout this study. Data Analyst A has taught for 17 years at an elementary school in San Diego Unified. Data Analyst A taught Kindergarten, first grade, and second grade. Data Analyst A currently teaches first grade. Data Analyst A also spent one year out of the classroom as a Math Resource Teacher supporting students in Kindergarten through 4th grade. Data Analyst B taught for two years at an elementary school in Lynwood Unified School District. Data Analyst B is currently teaching third grade. Data Analyst B prior to working in Lynwood Unified School District, worked outside of the classroom in numerous after school programs providing youth academic enrichment in Santa Ana, California. As the primary researcher, the Intervention Specialist collected all of the quantitative and qualitative data during the intervention, which included administering all the exams and surveys, conducted all interviews, and a reflective journal. Finally, Data Analysts A and B were responsible for analyzing and organizing the data.

**Intervention Plan**

The intervention used in this study was a flipped classroom approach. In a flipped classroom approach, traditional homework is done during class while video lectures and note taking are done at home (Cummins-Sebree & White, 2014). Often in a traditional classroom, the

level of understanding falls in one of these categories: above proficiency, proficient, or below proficiency. Often, students who get the math concepts get easily bored. With the flipped classroom approach, the lessons were tailored more to students' learning styles and pace. The lessons were tailored to students' learning styles because those students who understood the lesson did not find the need to sit there watching the entire lesson, those students who understood some of the lesson were able to skip parts of the video, and those students who really struggled spent more time watching the lesson and at times watching the lessons more than once.

The researchers wanted to change their style of teaching and in doing so, they needed to move away from a traditional approach. With a traditional method, teachers were at the center doing all the active work, while the students sat back and passively listened (Fulton, 2012). Using the flipped classroom approach, the Intervention Specialist gave students problems to solve within their small groups. Students then had enough time to collaborate and help each other get through the day's task. The goal was for the class discussions to be more meaningful since students came prepared to class having already watched the lesson(s). During class, teachers make better use of time making meaningful connections with their students and help facilitate the learning going on in a more advisory role (Fulton, 2012).

To perform the flipped classroom approach intervention, the Intervention Specialist created two to three lessons each week (one entire unit) for approximately four to six weeks using an iPhone or camcorder to record the lessons and upload them to YouTube. The Intervention Specialist conducted a four to six week intervention in an Algebra II class. The Intervention Specialist created several videos each week on the topic of Polynomial functions. Each lesson uploaded was 10 to 15 minutes in length and was the substitute for the lecture itself.

Class time was spent focusing on group activities, class discussions, working on problems, and independent exploration.

On the first day of week 1, the Intervention Specialist gave the students an introduction on how to view a flipped classroom video. One activity the Intervention Specialist conducted with his focused class was to watch a Khan Academy lesson, pausing and rewinding throughout, to show the class how to focus on the important information and the information that is not so important. Then as an assignment, the Intervention Specialist had the students watch another lesson and take notes as instructed to do so. After students had been done, they shared their notes and discussed what they wrote down and then shared questions with the class. The Intervention Specialist gave the students a survey to assess how each of them viewed their own abilities in mathematics, their perception of mathematics, and a Likert scale to measure motivation. Throughout intervention weeks one through six, students watched the videos at least two to three times a week. Students were required to take notes and write down questions that arose when watching the videos. These questions were essential for class discussions.

At the conclusion of this intervention, students were given a summative assessment (see Appendix F) to measure how well they understood this unit of study. Students also completed a self-assessment (see Appendix C) to see how their feelings about mathematics had changed as a result of this intervention and also take a motivation post-test (see Appendix D). The results were measured against the pre-assessment (see Appendix D) that the students took. The Intervention Specialist also randomly chose anywhere from three to eight students to conduct an interview about their experiences with the intervention (see Appendix B).

**Data Collection Methods**

The Intervention Specialist used several forms of validity to achieve credibility through triangulation with a pre and post assessment (see Appendix F and H) aligned with the Common Core State Standards associated with the Algebra II unit. This helped to answer the primary research question, “What impact would a flipped classroom approach have on academic achievement compare to a traditional classroom?” The pre-assessment was given before the intervention to serve as a baseline to compare academic achievement before and after the intervention amongst the participants. Baseline data is important to include prior to implementation of the intervention to have a better comparison to see the overall gain in academic achievement individually and as a whole within the class outcomes. This is essential to provide a comparable measure to effective instruction when answering the primary question.

The curriculum-based assessments for the targeted Common Core State Standards within the unit in Algebra II, are student-generated artifacts comprised of formative assessments to track each individual lesson. The mid assessment was used to begin a reflective inquiry to observe the progress of the study and make notes in the reflective journal for validity. This transferability was able to evaluate possible improvements from observations to make changes for future research implementation with other subject groups.

The post assessment served as a summative assessment to measure the overall effectiveness of the lesson compared to the flipped classroom and traditional direct in class instruction. The post assessments were comprised of standard based questions associated with the target Common Core State Standards taught in the unit. Later on, the post assessment were

compared to the pre-assessment to observe academic growth using the pre-assessment as a baseline.

A reflection journal was used by the Intervention Expert to provide clarification and critical reflection on student thoughts throughout the study to eliminate any biases or pre-judgments on data (see Appendix I). The information recorded in the reflection will consist of observable behaviors, along with any other anecdotal records of the participants within a class.

In addition, a survey (see Appendix A) was administered at the end of the study to the focus group using the inverted classroom pedagogy method to answer the secondary question, “In what ways do high school students’ perception on motivation and engagement differ between a flipped classroom and a traditional classroom approach as measured by surveys, class participation, and classroom observations?”

For the student survey (see Appendix H), questions were included to assist with gaining an understanding of possible underlying factors that can affect student perceptions. This helped take into account possible outliers that would have been otherwise invincible in the study. It is important to consider all viewpoints to maximize the overall findings. Also, the last question helped give a baseline to get an idea if the student had completed homework on a regular basis prior to conducting the study.

A survey was also conducted by intervention specialist in which the questions regarding student engagement were answered by the participants in order to provide data utilizing a rubric of observable behaviors in class (see Appendix E). The reflection journal and surveys served as credibility to support and measure student perceptions of engagement and motivation of both the student and the teacher’s perspective. The rubric used for the teacher survey consists of criteria

on observed patterns of behaviors as seen through notable actions of someone raising their hand to ask questions, collaborating with their peers, content of dialogue taking place within the group collaboration. The criteria of behavior patterns noted will be observable traits such as student dialogue to find common trends in their in class discussions and to record the types of engagement observed within both classes.

### **Ethical Research Practices**

In order to make sure that the action research followed ethical research guidelines the researchers made sure that all required authorizations were cleared before starting the part of the process that involved students. A site authorization (see Appendix G) was approved by the principal at the student's high school. Since the students are minors, parent consent forms (see Appendix J) were also signed for all students participating. Consent forms stated all the information of this intervention and included purpose and benefits. Student consent forms were signed by the students because all students were over the age of six. Students and parents were also made aware that the answers collected from the student surveys would be used as data.

### **Plan for increasing validity.**

One of the researcher's goals, was for the data to be collected in a professional manner to ensure credibility and that the potentially biased opinions of the researchers would not interfere with the outcome. The credibility of the pre and post-assessments supported accurate measures of scores to analyze based on an 80 point total scale to observe academic growth in support of the primary question, "What impact would a flipped classroom approach have on academic achievement compared to a traditional approach in high school mathematics as measured by surveys, assessments, observations, and class participation?" In addition, to support



triangulation of data, other strategies used were peer debriefing and observations, for triangulating data sources. The researchers utilized peer debriefing in order to discuss the study with a non-collaborating professional, who provided feedback without bias. Data was collected during the time of the study by participating in daily observations in order to observe the effects of the intervention as it was being administered. This allowed for immediate data updates.

Triangulating data is an important step in action research because collecting multiple sources of data increases the credibility of the research findings (Hendricks, 2017). The sources of data collected by the researchers were pre, and post assessments, classroom observations as well as participant surveys. This would help provide more credibility by providing a wider pool of data collection to analyze for a greater target of growth within the context of the high school mathematics course. In addition, to increase validity, transferability was also used to support ongoing observation between different participants within the study using a control group (traditional classroom), and a focus group (the flipped classroom approach). Description of the participants including demographics, and baseline of previous grades helped go beyond one classroom focused upon and allowed to differentiate between methods of observe and debrief upon within the study.

### **Confidentiality and informed consent.**

The student participants, their parents and school administration were informed of the study process, time frame, and goals. The student participants were given a parent consent form (see Appendix J) in English, Spanish, Mandarin, and Cantonese. The researchers took steps to ensure participant confidentiality. In order to ensure confidentiality within our study, the Algebra II class participants were all assigned a number from one to 33 to ensure anonymity. Anonymity

helped to ensure that students were open and comfortable to respond honestly to survey questions without worry of judgment. All records and items were maintained on a password-protected computer and hard copies were locked in a file cabinet within the classroom. At the conclusion of the study, all documents were destroyed to protect and guarantee participants' confidentiality. A possible risk that had to be addressed was the participants' lack of technology at home in order to be able to watch the necessary videos prior to attending class. This issue was addressed by making the computer lab on site available to students before and after school, so that the participants could view the videos.

## **Conclusion**

The researchers sought to investigate the effectiveness that a flipped classroom approach would have on the engagement, motivation and achievement of 10th through 12th grade Algebra II students. The intervention was conducted for a period of four weeks. During this period of time, the Intervention Expert gathered data, conducted pre and post assessment, and conducted students surveys. The compiled data was then used to demonstrate the effectiveness that a flipped classroom approach had on the engagement, motivation, and achievement of 10 through 12th grade Algebra II students. Chapter 3 provided insights to the setting, methodology according to the intervention that was implemented and the roles of the researchers. Chapter 4 will provide the findings, conclusions to the intervention, and recommendations for further research.

## **Chapter Four**

### **Findings and Discussion**

At the beginning of this action research project, all three researchers were interested in ways to increase motivation, engagement, and academic achievement in a high school math class, with the expectation that participating in a flipped classroom would lead to increased results. Before the intervention took place, the intervention specialist noticed that his students were often disengaged in Math class and apathetic towards learning. Their lack of engagement and motivation directly correlated with their performance on summative assessments. By participating in this intervention, the intervention specialist sought to reach the students in a way that related directly to them through the use of technology.

The purpose of the intervention was to examine the effects of a flipped classroom methodology on academic achievement, student engagement, and motivation in a high school mathematics classroom. Data comprised from pre and post-assessments represent grades received from both control and focus groups. The class in the control group received direct traditional instruction. The class in the focus group received the flipped classroom intervention covering the same content. Pre and post-surveys were analyzed to demonstrate their self-perceptions on motivation and engagement. Surveys were also examined to measure engagement between a flipped classroom and a traditional classroom. A reflective journal comprised of the intervention specialist's observations and anecdotal records was studied for qualitative research and critical reflexivity for validity. The data analysts used the reflective journal as a tool to understand the influential impacts that can possibly affect the intervention and have been noted as necessary.

Research participants were given a pre-assessment at the beginning of the intervention. Both the control group, who received a traditional direct face-to-face instruction, and the focus group, receiving the flipped classroom approach intervention, took the assessment to serve as a baseline to compare to the expected outcome of growth. The pre-assessment given was to record data on prior knowledge of polynomials to begin student work on unit 5 in their Algebra 2 class. The grade distribution based on percentage for the pretest are displayed in both Figure 3 and Figure 4. Figure 5 shows the pre-assessment and post-assessment results for the control and focus groups.

The findings from the pre-assessment administered at the start of the intervention show a fairly close range of cumulative class averages. For the control class, the class average was 5 points out of 80 points possible on the pretest and for the posttest, it was 60 points out of 80 points. For the focus class, the class average was 8 points out of 80 points on the pretest, and for the posttest, it was 65 points out of 80 points. In both the control and focus class, we see that students did not understand much of the material based on both classes failing the pretest. The results for the pretest are what was expected because most students learn the material as the teacher teaches each section. The posttest results show a significant growth where students knowledge increased from the beginning of this intervention to the end. By the bar graph provided in Figure 5, we see that a flipped classroom class average was 6% better than the traditional classroom.

## Traditional Classroom Pre-Assessment Grade Distribution

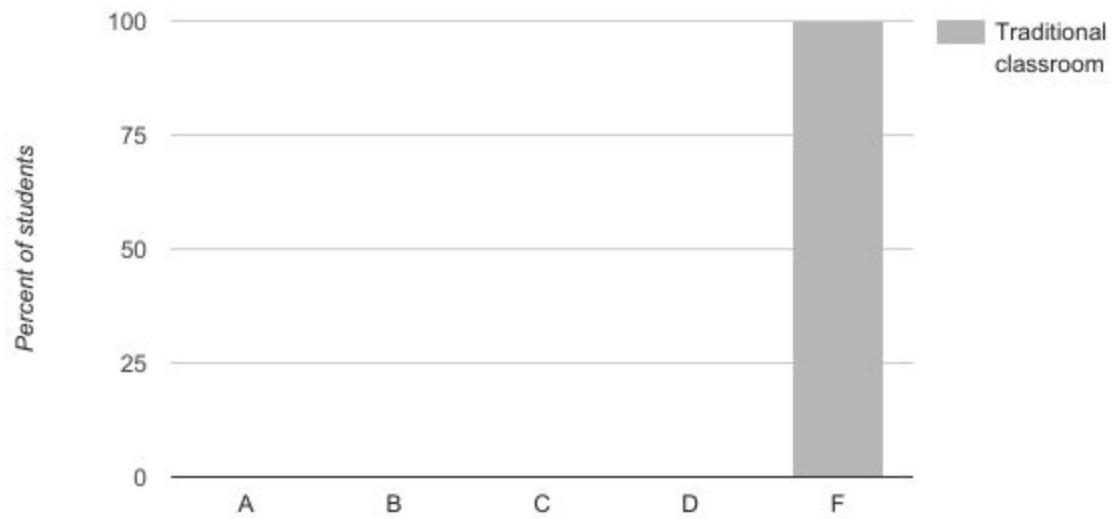


Figure 3. Traditional classroom pre-assessment percentage for 31 students.

## Flipped Classroom Pre-Assessment Grade Distribution

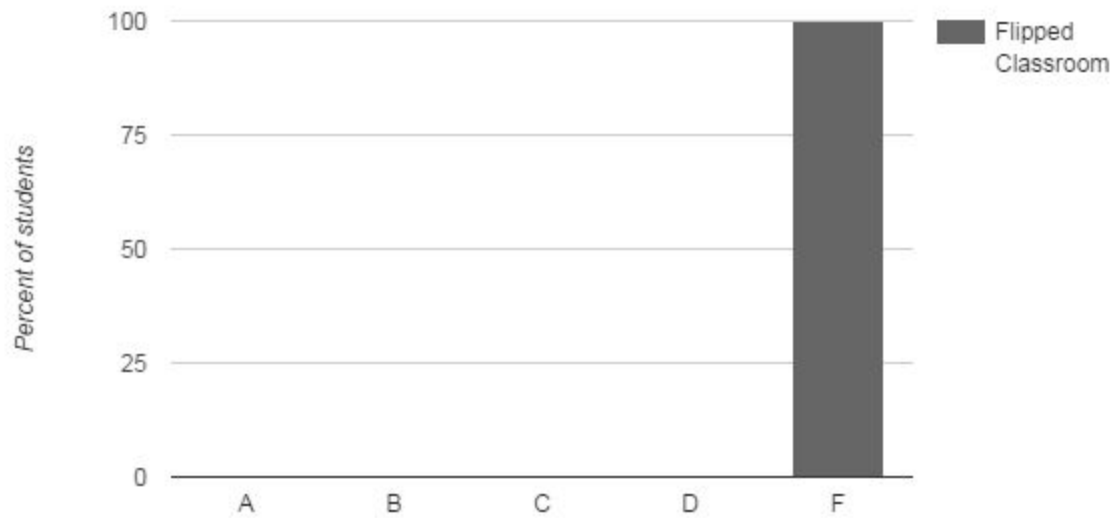


Figure 4. Flipped classroom pre-assessment grades for 33 students.

## Pretest and Posttest Results

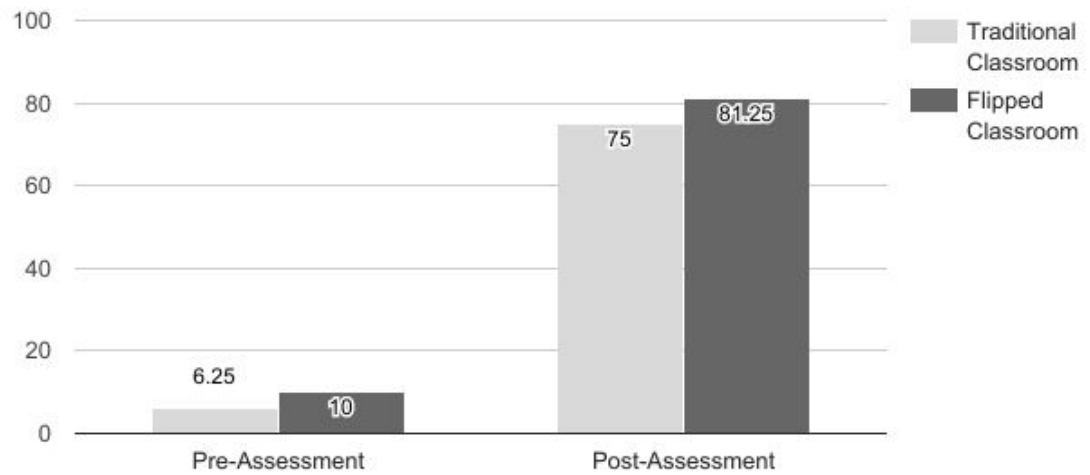
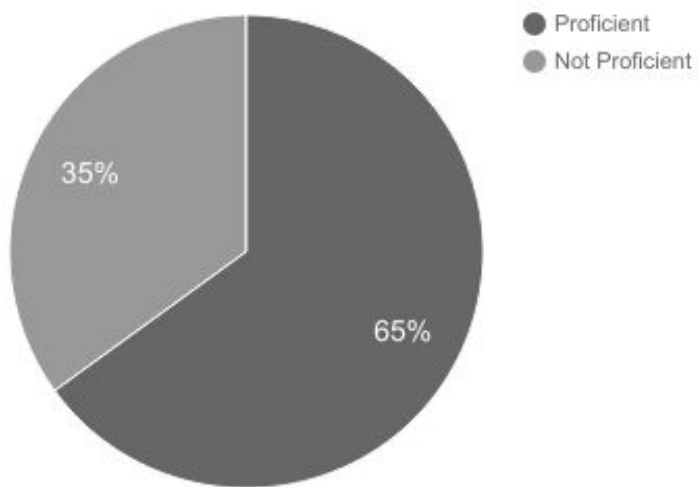


Figure 5. Traditional and Flipped classroom percentage results based on class averages

We can see from Figure 6 and Figure 7 show the percentage of students who ended up scoring at the proficient were greater in the flipped classroom than the traditional classroom. The focus group, which is the flipped classroom, performed at a 76% passing rate, while the control group which is the traditional class performed at a 65% passing rate. Again, we see that the flipped classroom did have a positive impact on the student's academic achievement. The findings from Figure 8 include the post assessment grades which showed that the flipped classroom approach was a success compared to the traditional classroom. The traditional classroom that served as the control group received the following scores: 12.9% of students got an F, 22.6% of students got a D, 25.8% of students got a C, 25.8% of students got a B, and 12.9% of students got an A, while the focus group that received the flipped classroom received the following scores: 9.1% of students got an F, 15.1% of students got a D, 27.3% of students got a C, 27.3% of students got a B, and 21.2% of students got an A. In Figure 9, we compared those students who earned an A, B, or C and divided that number either by 31 when describing the traditional classroom and 33 when describing the flipped classroom. We see in Figure 9 that the flipped classroom outperformed the traditional classroom by 11% as it is evident from the line graph.

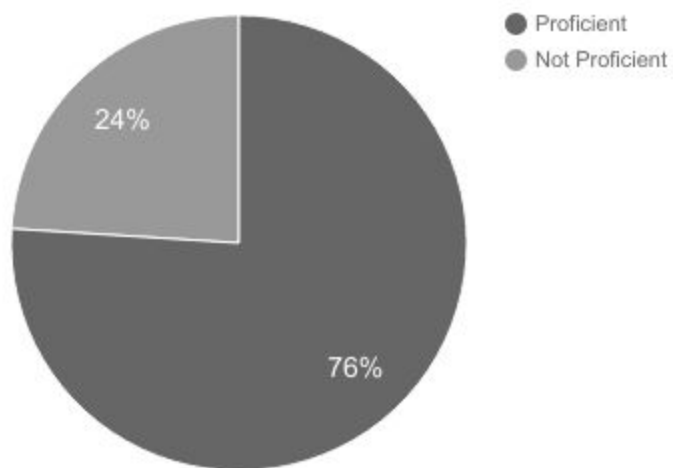


Percentage of Proficiency for Traditional Classroom



*Figure 6.* Traditional classroom proficiency percentage on post-assessment.

## Percentage of Proficiency for Flipped Classroom



*Figure 7.* Flipped classroom proficiency percentage on post-assessment.

## Post-Assessment Grades

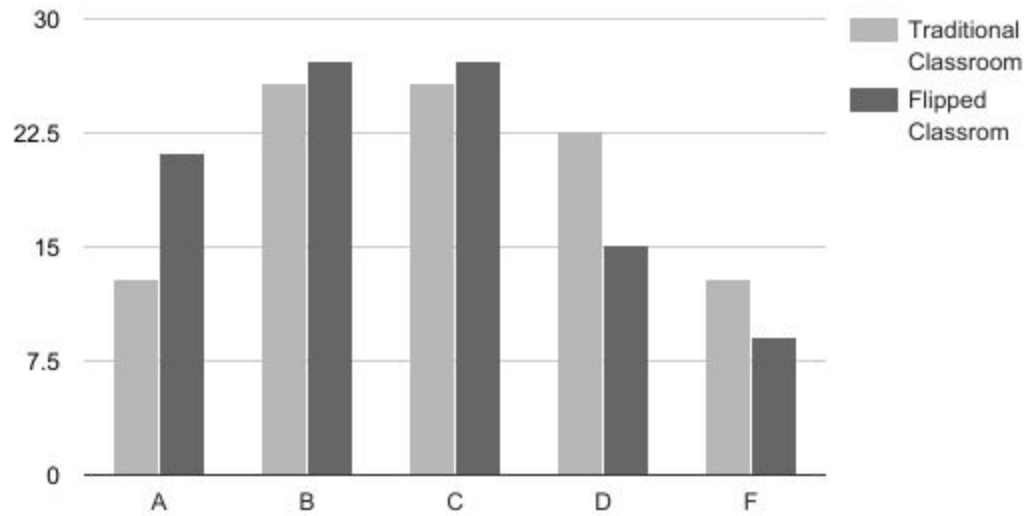


Figure 8. Post-Assessment distribution of grades based on percentages.

## Proficiency of Traditional compared to Flipped Classroom

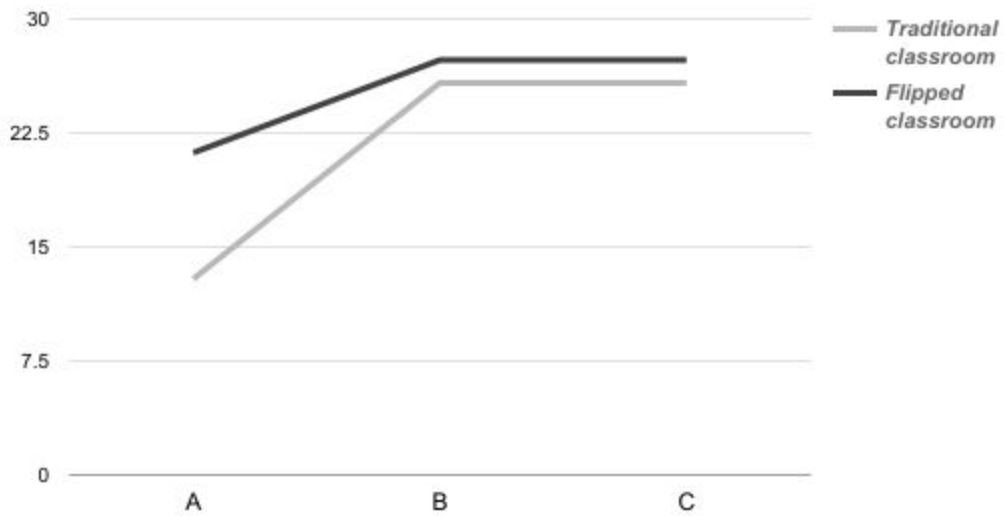


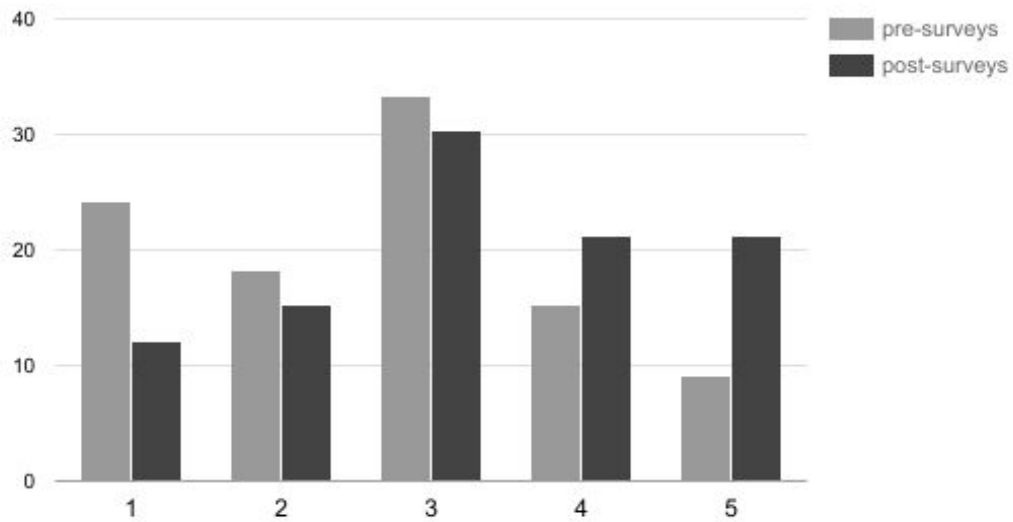
Figure 9. Traditional classroom versus Flipped classroom breakdown based on percentages.

The purpose of the secondary question was to determine in what ways the perceptions on motivation and engagement differ between a flipped classroom and a traditional classroom approach. Before the intervention was implemented student participants were given a pre-math self assessment survey to analyze their perceptions of their mathematics classroom. The students were then given a post survey after the intervention, and the surveys had a scaled score of one through five. One representing , not at all and five representing a lot. Once the data of the pre and post surveys were compiled and analyzed.

Question 1 addressed how students felt about attending math class. For the flipped classroom, before the intervention 24.2% of students rated their excitement about attending math class as 1 (not at all excited), 18.2% of students rated it as a 2, 33.3% of students rated it as a 3, 15.2% of students rated it as a 4, and 9.1% of students rated it as a 5 (very excited). After the intervention 12.1% of students rated it as a 1, 15.2% of students rated it as a 2, 30.3% of students rated it as a 3, 21.2% of students rated it as a 4, and 21.2% students rated it as a 5.

From these results, we see that students in this Algebra II class before the intervention had a 58% excitement level to come to class. After the intervention, we saw this same Algebra II class have an increase in excitement level to 72%. As a result, we saw a 14% increase in that students were excited to come to class. We can conclude that using the flipped classroom approach had a positive impact on the students motivational level.

Question 1: I feel excited to come to class.

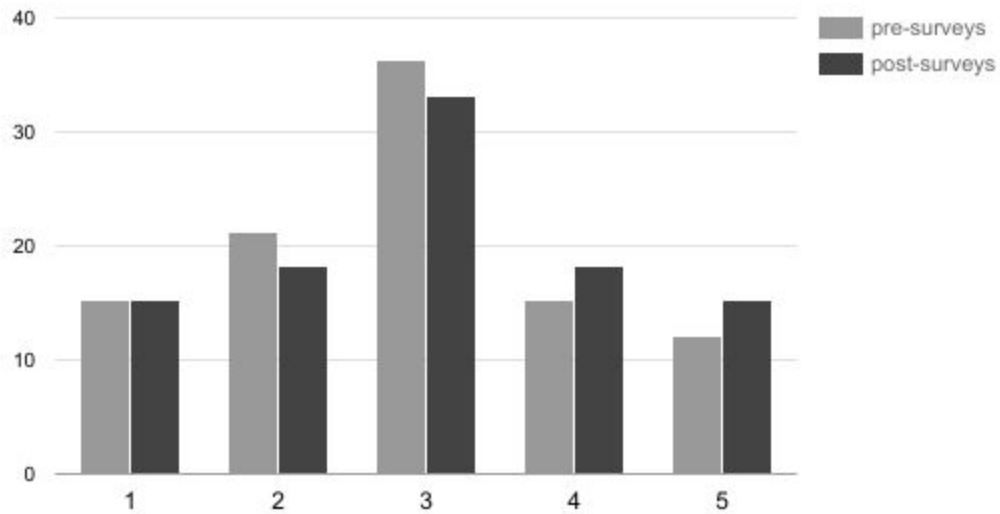


*Figure 10.* Flipped classroom percentage results on question 1.

In question 2, students were asked if they looked forward to a new lesson in class. In the pre-survey 15.2% of students rated it as a 1 (not at all), 21.2% of students rated it as a 2, 36.3% of students rated it as a 3, 15.2% of students rated it as a 4, and 12.1% of students rated it a 5 (a lot). In the post surveys 15.2% of students rated it as a 1, 18.2% of students rated it as a 2, 33.2% of students rated it as a 3, 18.2% students rated it as a four, and five students rated it as a five.

From these results, we see that 64% of students in this Algebra II class before the intervention were looking forward to a new lesson. After the intervention, we saw 66% of students were looking forward to a new lesson. As a result, we see a 2% increase in that students were looking forward to a new lesson. We can conclude that using the flipped classroom approach had some positive effect on these students, where they wanted to watch the next lesson.

Question 2: I look forward to a new lesson in class



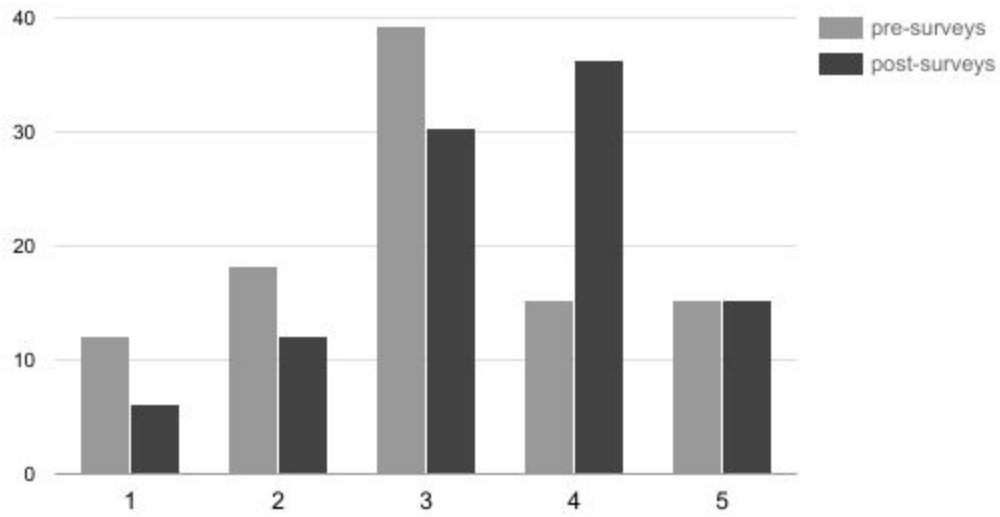
*Figure 11.* Flipped classroom percentage results on question 2.



In question 5, students were asked if they felt mentally focused in math class. In the pre-survey, 12.1% of students rated it as a 1 (not at all), 18.2% of students rated it as a 2, 39.3% of students rated it as a 3, 15.2% of students rated it as a 4, and 15.2% of students rated it as a 5 (a lot). In the post survey 6.1% of students rated it as a 1, 12.1% of students rated it as a 2, 30.3% of students rated it as a 3, 36.3% students rated it as a 4, and 15.2% of students rated it as a 5.

From these results, we see that 70% of students in this Algebra II class before the intervention were mentally focused. After the intervention, we saw 81% of students were mentally focused in this Math class. As a result, we see an 11% increase in that students were mentally focused in this Math class. We can conclude that using the flipped classroom approach had a positive effect on these students, where they were ready to discuss and collaborate with their fellow classmates.

Question 5: In class I feel mentally focused



*Figure 12.* Flipped classroom percentage results for question 5.

After the intervention students were interviewed and asked if they preferred the flipped classroom or the traditional classroom. Overall, students in the flipped classroom conveyed that watching the math instructional videos at home, made math more interesting and at times easier to comprehend and grasp concepts with ease. Many of the students appreciated watching the videos at home for reasons as being able to pause, rewind, come back to it if needed, comfort, and learning at their own pace. Student #2 said “While watching the videos at home, I found myself moving the video forward a lot because I understood most of the lessons before hand. This was my second time taking this class so I usually went straight to the examples.” According to Student #11, he said, “I enjoyed the videos and I was always ready to participate in class discussions and do examples on the whiteboard if called upon. The function I used the most was the stop button because at times I went to get food or had to use the restroom.” Several students mention the same thing about the math videos, that being able to come back at any time and play it again was very helpful especially since they struggle in math a lot. Student #19 said, “time in class was spent efficiently now that I was able to understand lessons from the videos. I was able to do my homework in class without worrying about not knowing how to do a problem.”

Many of the students interviewed expressed that they learned more with the math videos than taking notes in class. Student #16 said, “I was able to watch the videos on my phone wherever I was because the videos were online. This was very convenient for me because I was always showing up late to class and missing half the notes.” According to Student #23, “I honestly enjoyed the videos because overall I just feel that I learned and focused more. The videos helped me more than a traditional classroom because I was able to learn at my own pace.”

Student #1 said, “The videos were excellent for me because at times with the traditional classroom, the lesson moves too slow. I was able to finish all my homework because of the time given in class.”

### **Conclusion**

From the beginning of this intervention, the researchers wanted to find a way to increase students’ academic achievement, motivation, and engagement in a high school math class. By developing interactive and technological lessons, students’ engagement levels increased and more could be accomplished each class period (Akey, 2007). Partaking in an action research project utilizing technology, the intervention specialist used this information to improve engagement in his math classes. The Flipped Classroom approach proved to be effective in addressing improved performance and motivation among the math students. While the flipped classroom approach addressed researchers’ primary and secondary questions, the flipped classroom also improved in other areas as well. The intervention specialist observed an increase in communication and collaboration amongst the students. Students began discussing the lessons and sharing their work. They gained confidence in themselves and they were more comfortable sharing their thoughts and ideas, as compared to before the intervention.

Through collecting evidence, including observations, surveys, reflection journals (see Appendix I), and interviews, the intervention specialist concluded that the flipped classroom changed student performance and motivation to learn math. Throughout the intervention, student engagement consistently improved. The first week into the intervention, there was very little discussion among the groups since they were not familiar with the teaching strategies. Some students were working and discussing, while others were lost and began working on something

else. The intervention specialist moved around to facilitate, often encouraging them to discuss and remain on task. However, by the second week, there were significant improvements in discussions. Classrooms changed from a traditionally quiet environment into a hands-on student-centered learning environment; students began to work independently during class time. Discussions became very productive as everyone became involved and participated more, while the intervention specialist observed and facilitated the learning.

Overall, The Flipped Classroom proved to be a great tool to help improve student performance, engagement, and motivation. Although it was challenging in the beginning due to lack of student engagement and motivation, as more students became invested in the idea, most saw that the end result was worth it. Students who participated in The Flipped Classroom came to the conclusion that they were now engaged in student-centered learning, with the intervention specialist as the facilitator. By the end of the intervention, students and teacher learned the benefits of using technology in the flipped classroom. Key outcomes included increased collaboration, critical thinking, and increase in the social skills of students.

### **Recommendations for Further Research**

Before starting a flipped classroom intervention, it is imperative that the equipment for producing the videos and website for hosting the videos are thoroughly considered. The Intervention specialist encountered a few problems in the production of his videos, such as the inability to edit a previously made video. Teachers need to be familiar with the video software, plus the uploading onto a trustworthy site for students. Even though an individual instructor can be extremely effective in-person, producing videos can sometimes limit that effectiveness. Poor video quality or other technical difficulties can hinder flipped classroom videos (Milman, 2014).

The website being used should be interactive where students can log in and add comments, questions, and concerns. This would have been more effective because the teacher would have been able to answer student questions and other students could answer their classmates questions as well.

Another possible recommendation to look into is the ELL students. The videos may work for the whole class, but not for students who do not speak English. Trying to watch a video in a foreign language and learn something difficult to comprehend may be frustrating for ELL students. Perhaps getting input from all students (including ELL) could make the videos better since they are the target audience.

If the research were to be extended, it would be replicated in a way to create a focus group within the class, targeting English language learners (ELL) within the same demographics within the school environment. The intervention would then be tailored to utilize a flipped classroom approach as an intervention to differentiate curriculum and scaffold material in a comprehensible manner for ELLs. It can be utilized as an additional supplement to aid specified students. Lastly, this action research project can also be conducted across all subjects in hopes to increase academic growth, motivation, and student engagement.

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Appendix A  
Self-Assessment

1 .Was the video of the lesson easy to understand and were you able to do the practice problems correctly?

- Extremely easy (All correct)
- Okay (Only a few wrong)
- Somewhat easy (Did half correct)
- Not at all (Got a few correct )
- Very difficult to understand (All wrong)

2. Do you think your math understanding has grown because of a flipped classroom approach?

- A great deal (5)
- A good amount (4)
- A fairly good amount (3)
- A little bit (2)
- Not at all (1)

3. Do you feel that watching the math video before class helped your understanding of the math lesson?

- Strongly agree
- Agree
- Undecided
- Disagree
- Strongly Disagree

4. How comfortable were you with the math activity the next day?

- Very comfortable
- Comfortable, but I had some questions
- A little comfortable, I might need some modeling
- Not at all comfortable, I did not understand

5. How much technical problems kept you from your assigned online lessons for homework?

- A great deal (no internet access at home)
- A fair amount ( used Internet at computer lab/class)
- None at all (access to Internet at home)

6. How often have you completed homework before participating in the flipped classroom assigned video instructions?

- All the time (Completed all assignments)
- Most of the time (Rarely missed an assignment)
- Sometimes (Turn in homework sometimes)
- Never (No assignments completed)

Appendix B  
Interview Questions

1. After having both a traditional method of instruction (lecture) and a non-traditional method of instruction (flipped classroom) in a math class, which do you prefer? Why?
2. Compared with your normal homework assignments, what were your feelings about watching the flipped classroom videos instead?
3. How did the time spent in class change as a result of the flipped classroom?
4. Did you learn more than, about the same, or less than a typical math class as a result of the intervention? Please explain.
5. What were the benefits and challenges of learning through a flipped classroom?

Appendix C  
Math Self-Assessment

For each question, please circle the number that best represents your knowledge of math in the last week.

1. I feel confident in my math skills.

not at all

a little bit

a lot

1

2

3

4

5

2. I get the proper support to help me understand the math.

not at all

a little bit

a lot

1

2

3

4

5

3. I usually have no problem doing my homework.

not at all

a little bit

a lot

1

2

3

4

5

4. I struggle to understand the material covered in the classroom.

not at all

a little bit

a lot

1

2

3

4

5

5. I am able to remember what I learn in math.

not at all

a little bit

a lot

1

2

3

4

5

6. I am able to use my notes effectively when allowed for an assessment.

not at all

a little bit

a lot

1

2

3

4

5

Appendix D  
Motivation and Engagement Assessment

For each question, please circle the number that best represents your feelings towards math in the last week.

1. I feel excited to come to math class each day.

not at all

a little bit

a lot

1

2

3

4

5

2. I look forward to a new lesson in math.

not at all

a little bit

a lot

1

2

3

4

5

3. Getting a good grade in math class is not important to me.

not at all

a little bit

a lot

1

2

3

4

5

4. I try hard to make sure my homework is completed and turned in.

not at all

a little bit

a lot

1

2

3

4

5

5. In class, I feel mentally focused on math.

not at all

a little bit

a lot

1

2

3

4

5

6. I know that math is not my favorite subject, so I get easily distracted in class.

not at all

a little bit

a lot

1

2

3

4

5

Appendix E  
Researcher Reflections and Behavioral Checklist

In addition to the daily personal reflections, researchers will use daily checklist to record student behavioral attitudes. For each item, please circle “0” for no, “1” somewhat or sometimes true, or “2” for often or very true.

0	1	2	1. All students watched video prior to class.
0	1	2	2. Students actively participated in group discussion.
0	1	2	3. Check understanding: were there frequent questions.
0	1	2	4. Shared responsibilities within group.
0	1	2	5. Show understanding through homework/survey.

Researcher Initials: \_\_\_\_\_

Date: \_\_\_\_\_

Appendix F  
Pre and Post Assessment

Algebra 2

Name \_\_\_\_\_ ID: 1

## Chapter 5 TEST

Date \_\_\_\_\_ Period \_\_\_\_\_

**Simplify. Your answer should contain only positive exponents.**

1)  $\frac{4yx^0}{x^4y^{-4}}$

2)  $(3x^4)^{-2}$

**Simplify. Write each answer in scientific notation.**

3)  $(5.42 \times 10^6)(8.06 \times 10^1)$

**Divide.**

4)  $(x^3 - 10x^2 + 19x - 16) \div (x - 2)$

5)  $(r^3 + 2r - 9) \div (r - 2)$

**Find each product.**

6)  $(7b - 8)(3b^2 + 8b - 1)$

**Simplify each expression.**

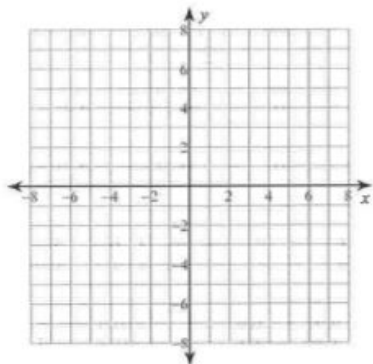
7)  $(3n^3 - n^4 + 7n^2) + (2 - 6n^4 + 4n^2)$

8)  $(5k^3 + 7k + 3) - (3k^3 + 8k + 5)$

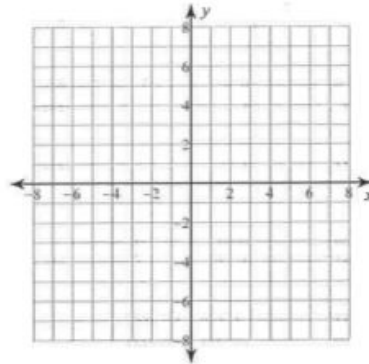


State the maximum number of turns the graph of each function could make. Then sketch the graph.

9)  $f(x) = x^3 - 6x^2 + 9x$



10)  $f(x) = x^3 - 4x^2 + 4$



Divide.

11)  $(3m^3 - 6m^2 + 30m - 26) \div (3m - 3)$

Write a polynomial function of least degree with integral coefficients that has the given zeros.

12) 3, -5, 4

13) -1, 2, -5

14)  $-3, -2i, 2i$

15)  $-1, \sqrt{7}, -\sqrt{7}$

**Factor each completely.**

16)  $15a^4 + 7a^2 - 30$

17)  $125a^3 - 8$

18)  $2n^3 + 7n^2 - 6n - 21$

**State the possible rational zeros for each function.**

19)  $f(x) = -25x^3 + 10x^2 - 2x - 4$

**Describe the end behavior of each function.**

20)  $f(x) = x^5 - 3x^3 + 3x + 1$

**Given polynomial  $f(x)$  and a factor of  $f(x)$ , factor  $f(x)$  completely.**

**21.**  $f(x) = x^3 - 6x^2 + 11x - 6$ ;  $x - 3$

**Given polynomial function  $f$  and a zero of  $f$ , find the other zeros.**

**22.**  $f(x) = x^3 + 2x^2 - x - 2$ ;  $-2$

**Find all the real zeros of the function (HINT: start with 1)**

**23.**  $f(x) = x^3 - 2x^2 - 5x + 6$

**24.**  $f(x) = x^4 - 3x^3 - 17x^2 + 39x - 20$  (HINT: use 1 twice)

**25.**  $f(x) = x^4 + 4x^3 - 6x^2 - 36x - 27$  (HINT: use  $-3$  twice)

Appendix G  
Site Authorization Form

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-----Authorization-----

I understand that participation in this project is confidential. Only the CUI students working on the project, collaborators, and capstone advisor will have access to students' identities and to information that can be associated with their identities.

The results of the Capstone Project may be presented publicly at CUI, to the PI's colleagues at his/her site, or to the PI's cohort and may be selected for publication in the CUI library.

Please check the appropriate box below and sign the form:

☒ I give permission for my educational institution to participate in this project.

☐ I do not give permission for my school to participate in this project.

  
Signature of Principal or Appropriate Administrator

2-17-17  
Date

\_\_\_\_\_  
Printed Name of Principal or Site Administrator

Appendix H  
Motivation Self-Assessment

1 .Was the video of the lesson easy to understand and were you able to do the practice problems correctly?

- Extremely easy (All correct)
- Okay (Only a few wrong)
- Somewhat easy (Did half correct)
- Not at all (Got a few correct )
- Very difficult to understand (All wrong)

2. Do you think your math understanding has grown because of a flipped classroom approach?

- A great deal (5)
- A good amount (4)
- A fairly good amount (3)
- A little bit (2)
- Not at all (1)

3. Do you feel that watching the math video before class helped your understanding of the math lesson?

- Strongly agree
- Agree
- Undecided
- Disagree
- Strongly Disagree

4. How comfortable were you with the math activity the next day?

- Very comfortable
- Comfortable, but I had some questions
- A little comfortable, I might need some modeling
- Not at all comfortable, I did not understand

5. How much technical problems kept you from your assigned online lessons for homework?

- A great deal (no internet access at home)
- A fair amount ( used Internet at computer lab/class)
- None at all (access to Internet at home)

6. How often have you completed homework before participating in the flipped classroom assigned video instructions?

- All the time (Completed all assignments)
- Most of the time (Rarely missed an assignment)
- Sometimes (Turn in homework sometimes)
- Never (No assignments completed)

7. How would you describe your experience using the flipped classroom approach?

## Appendix I

## Reflective Journal

**Week 1- March 6th-10th**

I introduced the idea of a flipped classroom to my second period class. They were excited to try something new and also to be of assistance to my master's program. I informed them of the purpose and procedures of my intervention. They were very intrigued with the concept of learning the material from home and doing activities in class along with time to work on their homework. I gave out a quick one question survey to see if everyone in my class had internet access and everybody did.

During this week we went over a Khan academy video to show my class how to take notes and watch math videos. I gave my class an activity to find a Math video on their own from Khan academy and they answered some questions for me. After, I answered any questions or concerns that my students had.

This week was a preparation week. I passed out the parent consent forms in Spanish, Mandarin, Cantonese, and English. I received all but 3 which they said they will bring it to me by Monday. I administered the pretest of Ch.5 which is Polynomials and I will get those tests to my group members by tomorrow. I also passed out the pre-survey on motivation level in a Math class and the pre-survey of student self assessment in a Math class. For my focus class and control class, I gave out assigned numbers to keep their identities anonymous. I uploaded my first 4 videos to YouTube which cover sections 5.1 and 5.2. For my focus class, I gave them their first homework assignment to view section 5.1 and be ready for the activity on Monday. I still need to record myself for the lessons on 5.3 - 5.6. If time permits we will cover 5.7, if not we



will cover it in the next chapter. My intervention started this weekend and I will see how many students did their homework by giving a video quiz on Monday. For those students that did not do their homework, they already know that they need to come to my room before first period.

### **Week 2- March 13th-17th**

This week the intervention has begun. The first thing on the agenda was to check how many students did their homework by viewing section 5.1-part 1. I had a short 3 question quiz asking them what color shirt I was wearing, how many examples did I go over, what example did I stop on. My videos on polynomial functions are up on YouTube for the first 2 sections. Students' homework for the week was to finish viewing four videos and I had an activity to check for their understanding. Students went around the room doing a gallery walk answering the 5 questions I had up. The questions were the examples that students had to finish while viewing the videos. Students were doing their homework by watching videos and coming prepared to class. I answered some of their questions and their fellow peers answered questions as well. On Monday I recorded that only 50 % of the students watch the videos, so the other 50% watch the videos in class because some did not make it to my class in the morning. But as Tuesday rolled around, we have an increase to 90% watching the videos. By Friday, we had 100% of students watching the videos so we will see some results when they take their 5.1-5.2 Quiz on Tuesday. I'm still recording myself after school, I just need sections 5.5 and 5.6 and I will have all the videos ready to upload for each given week of the intervention. My group and I are in constant communication and I will keep sending them data as I receive it. The plan for this week is for them to be ready to take their first quiz next Tuesday on sections 5.1 - 5.2.

**Week 3- March 20th - 24th**

This week the intervention continues and my students were watching section 5.3- part 1 and 2 for homework. Since my students were taking a quiz this week, I only assigned one section for them to view. Some complications I had with recording were that some videos went over my time limit of 15 minutes. I did not edit any of the videos up to this point but as my students were watching the videos, they noticed that the videos were improving. Some complaints I got from students' were that they were unable to read the slides so as a result I printed out the entire unit and gave it to everyone. The interest level was at an all-time high. There were many film critics in my class. I really liked that I was able to move around the class and help small groups and even individuals on different concepts rather than lecturing everyone on the same content. I even noticed that I had several teachers in my class, as there were a couple of students really intent on helping their peers. I enjoyed that everyone was on task either working on homework problems on the whiteboard, helping out their fellow classmates, getting ahead by watching the next videos, and working on the class activity for that week. The plan for next week is for them to watch section 5.4 parts 1 and 2. Next week is our Spring break so I will upload the videos for the rest of section 5.4 which includes parts 3 and 4 and have them practice by doing their homework. I'm finally done recording myself so I will upload sections 5.5 and 5.6 during our Spring Break.

**Week 4- April 3rd - 7th**

This week we focused on finishing up section 5.4 and getting ready to move on to section 5.5. During this week I passed out 2 exit slips and each exit slip had 2 questions from the videos. The motivation to watch the videos is still pretty high because 90% of my students were passing

the exit slips. By this week, I already knew that a flipped classroom approach had a positive effect on my students because I was receiving more homework assignments than usual and students were turning them in on time. The students are doing their part by coming prepared to class having watched the lessons the night before. I still have about one to three students who forget to do their homework and they have been coming in early to school to watch the videos in my class. In class, students are asking great questions that start our class discussions. Our class activities are going well too because students are doing their homework and coming to class prepared. Homework for the weekend was to begin viewing the first 2 videos on section 5.5.

#### **Week 5- April 10th - 14th**

I started this week by giving out another video quiz because I saw a decline on my videos in views on YouTube. I asked the class about it and a few responses were that some students were getting lazy and others just simply forgot to watch them. Yes I saw a decline in motivation this week but it was still higher than my other Algebra II class which is the traditional class. This week was a busy week because we finished up section 5.5 and students watched the last section 5.6. Some students were already asking if I was going to do a flipped classroom approach for chapter 6 which is the next unit and I told them no. I just explained to them that recording the videos is very time consuming and there were days when I could not record because I had no one to help me. During class, students were still asking great questions that started our class discussions. Our class activities went well because students were doing their homework by coming to class prepared. Students started watching part 1 and 2 of section 5.6 during this week as well. The plan for the next week was to finish up the unit and administer Chapter 5 post-test.

**Week 6- April 17th - 21st**

This week was the final week for the intervention as we finished up by Tuesday. Some students were sad, some were happy, and others didn't really care. The students had 2 days to review, finish correcting their pre-test, finishing up 5.6 homework, and getting their notebook ready to turn in to me. I gave out the post-surveys on motivation and engagement and math self assessment. The students took their Chapter 5 post-test on Friday and by student remarks and comments, I believed that they did very well. The students definitely appreciated the different approach to learning. Indirectly, I think the students appreciated the fact that their teacher was making an effort to improve students' learning and success. I had many students eager to participate in the post-intervention interview process. So, I did a random drawing to choose six students to interview. I really enjoyed talking individually with them about the process. I felt this was a way in which I could get some really good feedback. Each of the students that I spoke with, were very eager to add comments that contributed to the overall effectiveness of the intervention. I liked the idea that they were passionate about being a part of the intervention process. Overall, it's been a fun experience and I'm looking forward to calculating the results and implementing more aspects of the flipped classroom in the future.

## Appendix J

## Parent Consent Form

**Parental Consent of Research in an Educational Institution****PARENTAL CONSENT OF RESEARCH IN AN EDUCATIONAL INSTITUTION**

March 6, 2017

Dear Parent(s),

I will be conducting a study in our classroom to explore how a promising new instructional strategy, “the flipped classroom,” will impact students’ math performance, motivation, and engagement. The study will last approximately 4-6 weeks.

This is a requirement of my final capstone project (thesis) for my master’s degree at Concordia University Irvine, CA.

I am writing to ask permission to use the data I collect from your child during this process.

Participation in this study involves viewing two to three lessons online each week for approximately four weeks. Each lesson will be ten to fifteen minutes in length and are in lieu of a normal lecture. The following day, class time will be spent with the students actively working to

apply the concepts presented in the video. Students will complete a survey and a motivation questionnaire at the beginning and end of the study. In addition, I will ask 4-8 students to participate in an interview after the study to get their feedback about the study.

Principal Duane Russell has approved this study for implementation at Alhambra High School.

The purpose of the study is to learn about how “the flipped classroom” affects math performance, motivation, and engagement.

The potential benefits to your child for participating in this study include improved collaboration/communication skills, better understanding of math, leading to improved outlook in school.

Only Dr. Catherine Webb, my University Supervisor, co-investigators Ivette Amarillas and Christina Ellison, and I will have access to information that can be associated to your child’s identity. The data and documentation will be destroyed by June 1, 2017.

You may contact me at any time regarding your child’s participation. My phone number is 626-308-2342 and my email is mira\_steven@ausd.us

Use of data from your child is voluntary. You may contact me at any time if you decide you do not wish to have your child’s data included in the study.

Please check the appropriate box below and sign the form:

- ☐ I give permission for my child's data to be used in this study. I understand that I will receive a signed copy of this consent form. I have read this form and understand it.
- ☐ I do not give permission for my child's data to be included in this project.

---

Student's name

---

Signature of parents/guardian

---

Date

Sincerely,

Steven Mira