

Action Research: The Effectiveness of Using the “Flipped Classroom” Model to Teach Math in
Advance to Students from 9th Grade in Hawaii.

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Abstract

The new concept in learning known as the flipped classroom model have taken a lot of attention in the education community lately. The purpose of this study was to evaluate the effectiveness of using the “flipped classroom” model to teach math in advance to students from 9th grade in Hawaii. The instrument used to collect data were two questionnaires (One for students and another for parents). In general, the flipped classroom method is efficient and attractive solution to learn math in advance because students come to class more prepared. Consequently, the professor has more time to discuss fundamental concepts, real situation applications, and solve more creative math problems. The flipped classroom method is powerful strategy to teach math in advance because the students can watch the videos as many times as they want to full understand each math concepts and their applications. To improve the flipped classroom method for learning math in advance is to permit that students have the option to watch the videos after school in a computer lab under supervision of a math tutor. One strategy to motivate the students to study math using the flipped classroom method is to use videos with high quality using the best computer technology and computer design professionals available.

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Acknowledgment

I would first like to thank my family for supporting and encouraging me to complete this EDUC 793 Final Assignment. I would also like to thank my professor, Dr. David Jelinek, who has kindly given help and supported me to accomplish this study. Finally, I would like to thank my family and the Slammers soccer players and their parents who participated in the survey. Without their help, this study could not be completed.

Chapter 1 – Introduction

The new concept in learning known as the flipped classroom model has taken a lot of attention in the education community lately. In fact, Overmyer (2012) reported that during the past few months alone, articles on flipped classrooms have appeared in USA Today, The Economist, and The Washington Post, and educators have appeared on CBS' 60 Minutes to endorse the concept as well. A flipped classroom model uses teacher-created videos (classwork - lecture) to be watched by the students at home, and what used to be homework (assigned problems) is now done in class. It is called the "flipped" model because the whole classroom/homework paradigm is flipped. Also, the term "math in advance" means to create a premature background or basic notion about one math subject that will be learned in a traditional class soon. Chen (2008) reported that whether your child is academically gifted, or is simply eager to get a head start on college, many teens are choosing to learn in advance to graduate from high school early. On the other hand, there is a positive expectation that studying math using the flipped classroom model can motivate and facilitate students' math learning.

The purpose of this action research is to evaluate the effectiveness of using the flipped classroom model to teach math in advance to students from 9th grade in Hawaii. This study will focus on a classical 10th grade math class "Quadratic Equations" to check the effectiveness to teach math in advance using flipped classroom model.

Related History about the Researcher

In 1992, the researcher founded a private tutoring center called "PATRICK CHEVALIER ENSINO CLUBE DO ESTUDANTE S/C LTDA", which provides high quality teaching at a low cost to help young people improve their math skills. The researcher studied students from a

variety of well-regarded schools of Sao Paulo – Brazil, and observed very interesting methods and techniques that students had been taught at their respective schools. The researcher realized that a few days of intensive learning would enable even low background students to pass examinations and jump to the next grade. The strategies and techniques used to improve math achievement are:

- Teaching enthusiastically, with humor,
- Summarize the topic. For example, I like to give a procedure that the students can easily follow step by step to solve a problem,
- Be simple (e.g., remove steps from a traditional algorithm),
- Use exercises that the student normally has difficulties with,
- Recognize students' successes and praise them so that they became self-confident.

These tutoring techniques have worked well on students who have failed in a traditional math class, according the statistics provided by PATRICK CHEVALIER ENSINO CLUBE DO ESTUDANTE S/C LTDA. In fact, teaching enthusiastically with humor, summarizing the topic, being simple, using complex exercises that the student normally has difficulties with, recognizing students' successes and praising them so that they became self-confident can be used to facilitate the study in advance. In the next section, the researcher philosophy will be introduced.

Researcher Philosophy

My philosophy of study math in advance is to use these tutor strategies and techniques with the flipped classroom model before the traditional math class starts. The goal to learn math in advance using the flipped classroom model is to create a basic background and self confidence to

prepare students to face the math challenged from their schools. An advantage of study math in advance using the flipped classroom model is that students can be familiar with the math subjects in a short time without any pressure from their schools' performances.

The most important benefits of studying in Advance is not only to create a basic background for high school students, but also to feel their hearts with meaning and purpose. Kessler (2007) explained in the her book *The soul of education: Helping students find connection, compassion, and character at school* that films, games, TV, and Internet send pervasive messages offering our students a seductive and ultimate empty alternative to the existential search (p.61). Consequently, it increases the number of students who become depressed, attempt suicide, or use drugs. The researcher believes that studying math in advance can change positively students' lives, satisfying the search for meaning and purpose necessary to prepared them to face the college math challenges. Note that when students study math in advance, they are making a commitment with themselves to succeed in their traditional school, given directly or indirectly a meaning and purpose in their lives.

Statement of the Problem

The U.S. are not able to provide education that will develop more complex math skills necessary for the 21st century. Darling-Hammond (2010) explained in the her book *The flat World and Education* that political forces have repeatedly pushed most mathematics teaching in the United States back to the routines of the drill-and-practice methods. In the 21st century, the availability of abundant information, advanced technology can use the flipped classroom model to develop more math complex skills - not by a small slice of students from elite schools or advanced math programs, but for the vast majority of children in communities across the country.

Unfortunately, there are teachers not ready to flip. Overmyer (2012) reported two fundamental questions before implementing nationally the flipped classroom model in the U.S. system. Are your teachers open to new technology? Overmyer (2012) states that “once other teachers see how easy and effective flipping can be, other teachers can jump on board.” (p.46).

Unfortunately, there are students not ready to flip. Nielsen (2012) reported that many of our students don't have access to technology at home, and the flipped classroom method does not have strong provisions in place for these children.

I believe that the idea to implement directly the flipped classroom model as a national standard curriculum for mathematics high school students need at least a decade. Darling-Hammond (2010) reported that even minor changes in the secondary curriculum are going to cause bureaucratic fighting among education leaders and teachers. Therefore, the idea to implement directly the flipped classroom model as a national standard curriculum for mathematics high school students is discarded.

One possible short time solution to solve the math conflict between flipped classroom and the traditional models is to experiment with the flipped classroom model as a tool to create a background before the traditional class start. The problem is that advanced math skills are not being taught effectively in the 21st Century, and this study will investigate if using the flipped classroom will be effective.

Research Hypotheses

This section explains how the data was collected in the survey. Each research question is directed related with a correspondent question for each questionnaire.

Research Question 1. How do 9th grade students like to study math using the "Flipped Classroom" method in Hawaii?

Research Question 2. How are 9th grade students motivated to study math by "Flipped Classroom" method in Hawaii?

Research Question 3. How do parents like that their 9th grade children study math using the "Flipped Classroom" method in Hawaii?

Chapter 2 – Literature Review

Current State of Math Education in the U.S.

Mathematics in United States is losing ground to developed nations around the world. In fact, the Program in International Student Assessment (PISA) conducted an international assessment in 2006 where United States ranked 25th of 30 in the Organization for Economic Cooperation and Development (OECD) in mathematics, and has stayed at the bottom in the following years Darling-Hammond (2010) reported that the PISA assessments require more complex advanced analysis and knowledge than that used in most U.S. tests. The PISA defines literacy in mathematics that is increasingly emphasized in the curriculum and assessment systems of other nations. Unfortunately, these new mathematics ideas reflected in PISA assessments are often discouraged by the kind of textbooks and testing most often used in the United States (Darling-Hammond, 2010). The current state of math education in the U.S. does not prepare their students to 21th century and the University level. In the next section, remedial courses and add post-secondary math in high school curriculum attempts to diminish the math gap between secondary and tertiary level.

Remedial Courses and Add Post-Secondary Math in High School Curriculum Attempts

Bonham (2011) reported that there is considerable public debate about the unpreparedness of students entering colleges. To solve this problem, large number of students were placed into remedial or developmental courses. Attewell, Lavin, Domina, and Levey (2006) reported that remedial education is widespread, and their analysis indicate that about 40% of traditional undergraduates take at least one such course. Remediation is even more common among older nontraditional students. However, according to Bonham (2011), many students in remedial math

courses do not achieve their educational goals because they never complete these remedial courses.

Bellomo and Strapp (2008) reveal inadequate high school preparation in terms of disciplinary content or depth, conceptual grasp, or study skills, and show how course scope, goals, structure, and analysis of the curriculum do not prepare high school students to face undergraduate degrees in mathematics. The purpose of this qualitative research is to arrive at a solution to the quantity and quality of students pursuing studies in mathematics at the university level. Instead the remedial courses at the university, Bellomo and Strapp (2008) introduced high school students to a list of college classes like Calculus, Statistical Methods, Differential Equations, Linear Algebra, Probability Theory, Discrete Mathematics, Elementary Theory of Numbers, History of Mathematics, Abstract Algebra, and College Geometry. Although this program has not currently been field tested, the proposed Survey of Advanced Mathematics Topics class could increase the quantity and quality of students pursuing studies in mathematics at the university level.

Another attempt to introduce calculus in high school curriculum was done by Rodrigues and Le (2011). In order to help graduates succeed in college, a high school redesigned its senior year math courses as a bridge to post-secondary education. They reported that the University Park, a 234-student grade 7–12 school in Worcester, Massachusetts, brings into the senior year of high school, college-success courses about college policies and expectations, acquire time-management and study skills, address test-taking anxiety, and a college placement test to seniors to detect their readiness for college math. These courses can diminish the gap between the high schools and the colleges.

Hannah, James, Montelle, and Nokes (2011) also reported that from 2003 to 2008, almost 400 students around New Zealand took the University of Canterbury (UC) course in Advancing In Mathematics (AIMS). This course is equivalent to a full first-year university calculus and algebra course delivered in a high school style. The students, enrolled in the AIMS course during their final high school years, form their own peer support groups which can be seen to continue during their first year of college study. This is an important positive factor of accelerated study programs.

Hill (2010) explained that concerns about the math gap between high school and college have led to cries for change in high school mathematics. Policymakers have urged raising graduation requirements in an effort to increase the number of students who take advanced math classes. However, high school students especially among Black, Latino, and Native American youth and students of low socioeconomic status exacerbates this challenge of taking advanced math classes. In the next section, the emergence and innovation of flipped classroom method.

The flipped classroom method at the Byron School District.

The flipped classroom model can solve partially the math textbooks problem from the last century. For instance, Fulton (2012a) reported that the Byron School District near Rochester, Minn., faced a perfect storm of academic and financial challenges in Fall 2009. The school needs to order new high school math textbooks because the old ones poorly matched to new state math standards, but there were no funds available. The math teachers stepped up to the challenge and came up with a radical idea to create their own curriculum using online resources. Thus was borne the bookless 24/7 math curriculum from which Byron High School's "flipped classrooms" emerged. It was a crash course in innovation, given that the teachers hadn't even heard of flipped classrooms when they began the process. But they were determined to develop their own

curriculum aligned to state standards and dedicated to finding the best solution for their students. Fulton (2012a) explained that in a traditional classroom, teachers demonstrates how to solve the math problems during the constraints of the class period. As a result, the teacher is doing the active work, and the students are passively listening. Fulton (2012a) explained for students who understand the material and the lectures the length of the class period is just right, but for those who struggle there isn't enough time to understand the class. These students must arrange to meet with teachers after class or spend frustratingly long stretches at home trying to recall and make sense of what was delivered in the class lecture. Thus the flipped classroom model permits students with math difficulties to watch the video over and over as needed until the concepts become clear. Furthermore, Fulton (2012a) reported that using the flipped classroom model, students achievement is increasing with, and there is more interest and engagement in higher-level math. Fulton (2012b) reported that math mastery at Byron High has jumped from 29.9 percent in 2006 to 73.8 percent in 2011, according to the Minnesota Comprehensive Assessments. Also, ACT scores have risen from an average composite score of 21.2 (on a scale of 36) in 2006 to 24.5 in 2011. Fulton (2012b) also reported that Byron was selected as a National Blue Ribbon School by the US Department of Education in 2010, and it was honored as Intel's "School of Distinction" for high school mathematics in September 2011.

Flipped classroom model at Byron High School to learn quadratic equations.

The flipped classroom model has positive results when applied to teach the classical math topic quadratic equation. Hart (2012) reported that Byron High School (MN) math teacher Troy Faulkner has used the flipped classroom model to teach how to solve quadratic equations. The Troy Faulkner students have to met his 5 p.m. deadline to load a video demonstration of the

following day's lesson onto YouTube. Faulkner explained that his students are anxious to log onto Moodle (Modular Object-Oriented Dynamic Learning Environment), a free source e-learning software platform, to watch him solve quadratic equations. In the next day, Faulkner will work with students as they demonstrate how well they understand the concepts laid out in the lecture the night before. Fulton (2012b) reported that students like the change. They like that the quadratic equations videos are short--10 or 15 minutes at most. Now, If students are out sick or have to miss a class for some reason, they don't fall behind. Students also have to take more responsibility for their own learning. On the other hand, teachers see greater parental involvement as well, and most parents are now happy with the new methods and curriculum.

In short, pushing in one direction a large number of traditional schools are not able to provide education that will develop more complex math skills necessary for the 21st century. Pushing in another direction to implement directly the flipped classroom model as a national standard curriculum for mathematics high school students need at least a decade. One possible short time solution to solve the math conflict between flipped classroom and the traditional models is to experiment flipped classroom model as a tool to create a background before the traditional class start. In the next chapter is divided into five different sections: Method of Inquiry, Population and Sampling Techniques, Measurement and Instrumentation, Research Hypotheses, and Limitations and Constraints.

Chapter 3 – Methodology

Purpose

This qualitative action research purpose is to evaluate the effectiveness of using the flipped classroom model to teach math in advance to students from 9th grade in Hawaii. This chapter is divided into five different sections: Population and Sampling, Measurement and Instrumentation, Research Hypotheses, and Limitations and Constraints.

Population and Sampling

The population of this study is the 9th grade students from the state of Hawaii, and the convenient sample for this study was 9th students from a Hawaiian soccer team named “Slammers”. The sample has thirteen 9th grader who participated in this study came from Hawaiian private and public schools. The fifteen students and their parents filled the questionnaires to collect data for this study.

Measurement and Instrumentation

The instrumentation that was used in this study to evaluate the effectiveness of using the flipped classroom model to teach math in advance to students from 9th grade in Hawaii were two questionnaires (One for students and other for parents). This qualitative action research employed the use of questionnaires because it was impossible to interview every respondent. The anonymity associated with completing this type of survey provides students and parents the opportunity to express their perspective without fear of reprisal. Consequently, individuals are able to evaluate effectively the flipped classroom model to teach math in advance and find ways to improve the method. The questionnaires were generated, the data was collected, and the descriptive and statistical analysis of the responses was accomplished by *Google Docs*. This

software can create a simple or in-depth online surveys, share them from a link, embed them on your website, or even right inside an email, and organized in a Google spreadsheet for a descriptive and statistical analysis of the responses. Both students and parents questionnaires consist of five questions: two multiple choice questions with nominal scales, and three open-ended questions to measure important facts, attitudes, or values to evaluate the effectiveness of using the flipped classroom model to teach math in advance to students from 9th grade in Hawaii. For the multiple-choice questions (1 and 4) from both questionnaires, a descriptive statistics about the answers were analyzed from the Google Doc worksheet. For the open-end questions (2, 3, and 5), a descriptive statistic of the possible patterns will be analyzed. In the next subsection, the three research hypotheses and how the data was collected through both questionnaires.

Research Hypotheses

This section explains how the data was collected in the survey. Each research question is directed related with a correspondent question for each questionnaire.

Research Question 1. How do 9th grade students like to study math using the "Flipped Classroom" method in Hawaii?

Research Question 2. How are 9th grade students motivated to study math by "Flipped Classroom" method in Hawaii?

Research Question 3. How do parents like that their 9th grade children study math using the "Flipped Classroom" method in Hawaii?

Questionnaire for Students

Student Question 1. Is math important to you to achieve their professional goals? (Not important, .. , Very important).

Student Question 2. Did you like to study math using the "Flipped Classroom" method?

Why? (Used to answer research question 1)

Student Question 3. Are you motivated to study math by "Flipped Classroom" method?

Why?(Used to answer research question 2)

Student Question 4. Are online courses important to you to learn math in advance (Before the traditional class)?

Student Question 5. Do you have any comments about this math study or experience?

(Evaluate professor, video, flipped classroom method, or anything you want).(See appendix A)

Questionnaire for Parents

Parent Question 1. Is math important to your child to achieve their professional goals? (Not important, .. , Very important).

Parent Question 2. Did you like that your child study math using the "Flipped Classroom" method? (Used to answer research question 3)

Parent Question 3. Is your child motivated to study math by "Flipped Classroom" method?

Parent Question 4. Are online courses important to your child to learn math in advance (Before the traditional class)?

Parent Question 5. Do you have any comments about this math study or experience?

(Evaluate professor, video, flipped classroom method, or anything you want).(See appendix B).

Limitations and Constraints

The first limitation was the time to accomplish this research. The maximum time to complete this research was approximately two month. Some of the limitations of this study include external validity, or the generalization of the study.

Chapter 4 – Results

Purpose

There are two questionnaires (One for students and another for parents) with five questions each to collect the qualitative data. In both questionnaires, the first and fourth questions are multiple-choice and the second, third, and fifth questions are open-end. For the multiple-choice questions (1 and 4) from both questionnaires, a descriptive statistics about the answers were analyzed from the Google Doc worksheet. For the open-end questions (2, 3, and 5), a descriptive statistic of the possible patterns will be analyzed. In the next subsection, the descriptive statistics present the results from both questionnaires.

Descriptive Statistics

The frequencies, percentages, means, and standard deviations of each of the possible answers of the first and fourth questions (1 and 4) from students' questionnaires are indicated in Tables 1 and 4. The frequencies, percentages of each pattern from students' questionnaires are indicated in Tables 2, 3, and 5. The frequencies, percentages, means, and standard deviations of each of the possible answers of the first and fourth questions (1 and 4) from parents' questionnaires are indicated in Tables 6 and 9. The frequencies, percentages of each patterns from parents' questionnaires are indicated in Tables 7, 8, and 10.

Table 1

Frequencies and percentages of the students question 1

1. Is math important to you to achieve their professional goals?	Frequencies	(%)
1. Not important	0	0
2. Kind of important	1	6.7
3. Neutral	2	13.3
4. Important	3	20.0
5. Very important	9	60.0
No answer	0	0

Notes: N = 15, Mean = 4.33, and Std Deviation = 1

Table 2

Frequencies and percentages of the students question 2:

2. Did you like to study math using the "Flipped Classroom" method? Why?	Frequencies	(%)
Yes, students can pause and replay the video as necessary.	5	33.3
Yes, students can watch the videos at your leisure at home.	2	13.3
Yes, the videos give a preview of the lesson before the traditional class.	2	13.3
Yes, the flipped classroom method gives the students time to absorb the material and then they can come up with questions to ask the instructor during the traditional class that follows.	2	13.3
Yes, students can use the class time to practice problems.	1	6.7
Yes, students come to class prepared.	4	26.7
No, no one can answer my questions during the video.	1	6.7
No answer	0	0

Notes: N=15, Students' Answers: Yes = 93.3% No = 6.7%

Table 3

Frequencies and percentages of the students question 3:

3. Are you motivated to study math by "Flipped Classroom" method? Why?	Frequencies	(%)
Yes, it is an easy and convenient way to study math.	4	26.7
Yes, videos are a different way of seeing math.	1	6.7
Yes, in the flipped classroom, the video has important concepts and easy examples for students to be familiar before the class.	2	13.3
Yes, the flipped classroom seems to be a promising learning method to reach all students.	1	6.7
Yes, the students can replay the video over and over until they understand.	5	33.3
Yes, the students are motivated because they come to class prepared.	3	20.0
Yes, math is easier and the students can learn fast using the flipped classroom method.	2	13.3
Yes, using the flipped classroom method, students are more comfortable to understand the professor's explanations in the limited class time.	1	6.7
No, when I am seeing the video, nobody can explain my questions.	1	6.7
No, the video needs to be more attractive with more colors and pictures.	2	13.3
No answer	0	0

Notes: N=15, Students' Answers: Yes = 80.0% No = 20.0%

Table 4

Frequencies and percentages of the students question 4:

4. Are online courses important to you to learn math in advance?	Frequencies	Percentages (%)
1. Strongly disagree	1	6.7
2. Disagree	2	13.3
3. Neutral	1	6.7
4. Agree	5	33.3
5. Strongly agree	6	40.0
No answer	0	0

Notes: N = 15, Mean = 3.87, and Std Deviation = 1.3

Table 5

Frequencies and percentages of patterns of the students question 5 (Comments):

5. Do you have any comments about this math study or experience?	Frequencies	(%)
I really liked the creative problems because they are a real challenge.	1	6.7
I loved the integer method to find the fast solution of the quadratic equations.	1	6.7
It is very important that students are tutored when using the flipped classroom model.	1	6.7
The flipped classroom can be use to solve higher math problems.	1	6.7
The flipped classroom seems to be a promising learning method to reach all students.	1	6.7
The videos are very good technology and flipped classroom method makes the learning easier than the traditional classes.	4	26.7
I love learning ahead so this video taught me well ahead.	2	13.3
I will watch if he makes more videos.	2	13.3
The three first videos were at the right pace and good, but the 4 th video rushed into things too fast.	1	6.7
The professor is excellent.	1	6.7
The professor is very clear.	4	26.7
I got what the professor was saying, but it wasn't clear all the time.	1	6.7
The professor motivates me to learn more and more.	1	6.7
Some videos have a lot of external noises that can distract the audience.	1	6.7

Learning on videos is too hard.	1	6.7
The videos need more excitements.	2	13.3
No answer	2	13.3

Notes: N=15, Students' Comments: Positive = 82.0%, Negative = 18.0%, No answer = 13.3%

Table 6

Frequencies and percentages of the parents question 1

1. Is math important to your child to achieve their professional goals?	Frequencies	(%)
1. Not important	0	0
2. Kind of important	0	0
3. Neutral	0	0
4. Important	1	8.3
5. Very important	11	91.7
No answer	0	0

Notes: N = 12, Mean = 4.92, and Std Deviation = 0.3

Table 7

Frequencies and percentages of the parents question 2:

2. Did you like that your child study math using the "Flipped Classroom" method? Why?	Frequencies	(%)
Yes, it made me remember taking math in high school and college, and I didn't understand. Now, watching the videos the topic is easier and interesting.	1	8.3
Yes, I loved the integer method to solve quadratic equations.	2	16.7
Yes, parents like that their children use the flipped classroom method because it is more accurate and more efficient than the traditional class.	1	8.3
Yes, the flipped classroom seems to be a promising learning method to reach all students.	1	8.3
Yes, the videos are very good technology and flipped classroom method makes the learning easier than the traditional classes.	3	25.0
Yes, parents are eager to see if flipped classroom will spark a love for Math.	1	8.3
Yes, parents like the flipped classroom method because my child can learn ahead.	3	25.0
Yes, parents like the flipped classroom method because my child can watch the videos as many times as he wants.	3	25.0
Parents like that their children use the flipped classroom method because they can avoid math anxiety.	1	8.3
Yes, parents like that their children use the flipped classroom method because it is the future.	1	8.3
Yes, parents like that their children use the flipped classroom method because it is a different and interesting way to learn math.	2	8.3
No, my child refused to watch the videos.	1	8.3
No, my child doesn't want to learn math in advance.	1	8.3

No answer	0	0
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Notes: N=12, Parents' Answers: Yes = 83.3% No = 16.7%

Table 8

Frequencies and percentages of the parents question 3:

3. Is your child motivated to study math by "Flipped Classroom" method?	Frequencies	Percentages (%)
Yes, my child was motivated to study math by flipped classroom method because he can be familiar with the concepts and examples before the class. In particular, he liked the integer method from the first video because he can solve quadratic equations with integer solutions faster than using quadratic formula. If the solutions are not integer, the method can be used to check the solutions.	1	8.3
Yes, my son was motivated to study math by flipped classroom method in this study because he is seeing quadratic equations at his school. Using videos with different methodologies certainly will increase his school math performance.	3	25.0
Yes, my child likes the idea of studying math in advance because he will come to class more prepared.	4	33.3
Yes/No, I am not sure.	1	8.3
Yes, our child was motivated since he learned a similar method that also uses sum and product of the solutions of a quadratic equation (Integer method).	1	8.3
Yes, my son was motivated because he would like to watch more math videos.	2	16.7
No, math may not be the most exciting subject for children to spend their time versus play video games or watch TV.	2	16.7
No, my child doesn't pay too much attention to the videos.	1	8.3
No answer	0	0

Notes: N=12, Parents' Answers: Yes = 75.0% No = 25.0%

Table 9

Frequencies and percentages of the parents question 4:

4. Are online courses important to your child to learn math in advance?	Frequencies	Percentages (%)
1. Strongly disagree	0	0
2. Disagree	0	0
3. Neutral	4	33.3
4. Agree	3	25.0
5. Strongly agree	5	41.7
No answer	0	0

Notes: N = 12, Mean = 4.08, and Std Deviation = 0.9

Table 10

Frequencies and percentages of patterns of the parents question 5 (Comments):

5. Do you have any comments about this math study or experience?	Frequencies	(%)
The professor is the best making the life easier for the kids.	2	16.7
Learning in advance is very important because kids develop self confidence and motivate them to learn more.	2	16.7
The video is well done.	1	8.3
The flipped classroom is a very interesting method because the students won't get lost in the classroom.	1	8.3
I loved the idea for flipped classroom method because kids can learn in advance at home.	3	25.0
Parents are eager to see if flipped classroom will spark a love for math.	1	8.3
I strongly agree that the movies can prepare students to the class and improve students' math performance.	1	8.3
The professor need to be more entertaining to keep child's interest in a high level.	2	16.7
The flipped classroom method can facilitated the professors life because they need to do the lessons once and can use it many times. Also the lessons are more consistent between classes (If professor is teaching multiple classes).	1	8.3
I would prefer a video in the traditional classroom environment. For example, students can discuss the video after watching it.	1	8.3
There are also a lot of video on youtube.com that students can view to get more information on a particular topic.	1	8.3
The professor was knowledgeable in his discussion of quadratic equations and methods to solve them. Simple examples were given to illustrate how to use sum and product to solve or check the solutions.	1	8.3

Running head: MATH IN ADVANCE USING FLIPPED CLASSROOM MODEL 30

The advantage to use the flipped classroom method is that if part of the lecture is too fast, you can always pause, stop, and rewind back to the part you did not understand or missed while taking notes or working in a problem. 3 25.0

The flipped classroom seems to be a promising learning method to reach all students. 1 6.7

The disadvantage of using video is that students can not raise their hand to ask a question if you did not understand a concept or problem. 2 16.7

Students may want more than simple writing on a computer screen. For example, add colors, graphs, and pictures to the movies can illustrate the topic and their applications in a real life situations. This way, students will know the importance to study math. 2 16.7

No answer 0 0

Notes: Total: 21 comments from 12 parents, Positive = 81.0%, Negative = 19%.

Table 11

Percentages of positive answers from student questionnaire

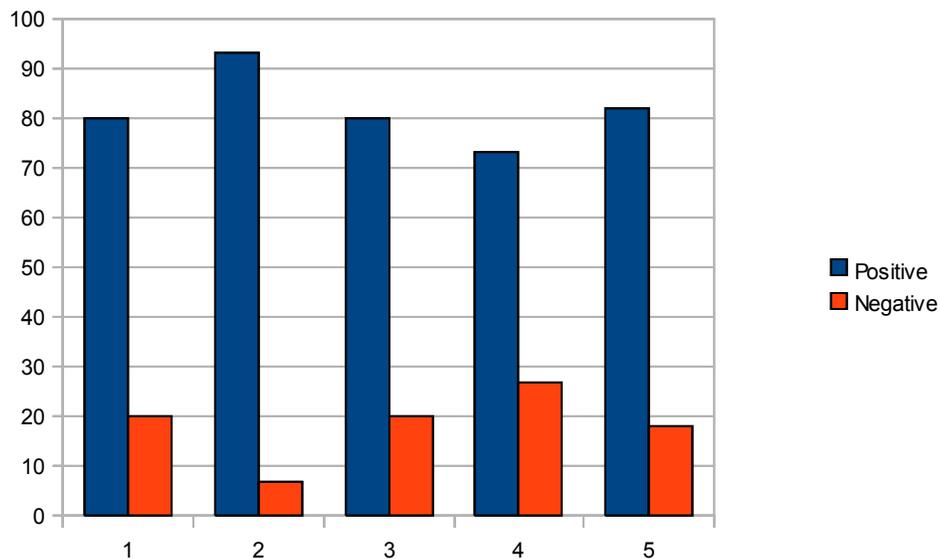
Students questionnaire	Answers (%)	
	Positive	Negative
1. Is math important to you to achieve their professional goals?	80.0	20.0
2. Did you like to study math using the "Flipped Classroom" method?	93.3	6.7
3. Are you motivated to study math by "Flipped Classroom" method?	80.0	20.0
4. Are online courses important to you to learn math in advance?	73.3	26.7
5. Do you have any comments about this math study or experience?	82.0	18.0

Note: No answer was considered a negative answer

Graph 1

Percentages of positive and negative answers from student questionnaire

(%)



Questions

Table 12

Percentages of positive answers from parent questionnaire

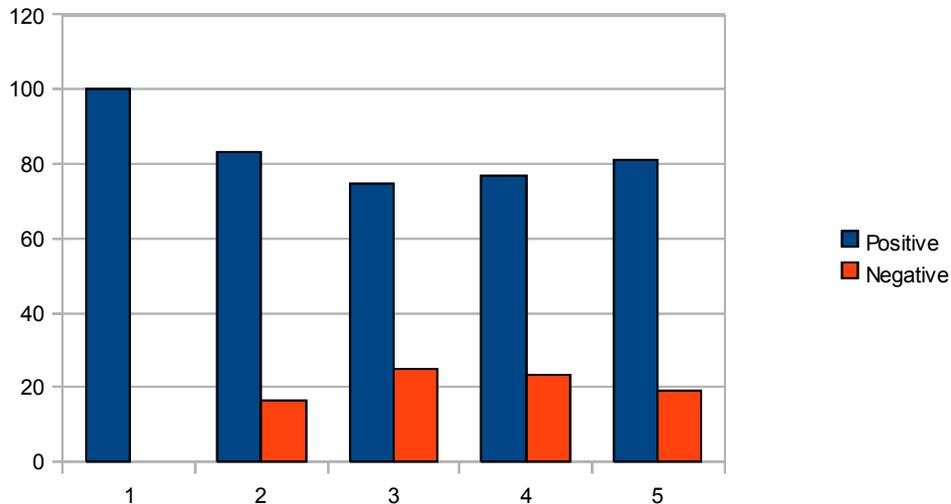
Parents questionnaire	Answers (%)	
	Positive	Negative
1. Is math important to your child to achieve their professional goals?	100.0	0.0
2. Did you like that your child study math using the "Flipped Classroom" method?	83.3	16.7
3. Is your child motivated to study math by "Flipped Classroom" method?	75.0	25.0
4. Are online courses important to you to learn math in advance?	76.7	23.3
5. Do you have any comments about this math study or experience?	81.0	19.0

Note: No answer was considered a negative answer

Graph 2

Percentages of positive and negative answers from parent questionnaire

(%)



Questions

Fifteen 9th grade students and twelve parents from the Slammers soccer team participated in this study. The quantitative results from students and parents questionnaires are summarized in the table 13.

Table 13

Descriptive analysis from questions 1 and 4 from student and parent questionnaires

Questions from Students and Parents Questionnaires	Descriptive Analysis	
	Means	SD
Student Q1. Is math important to you to achieve their professional goals?	100.0	0.0
Student Q4. Are online courses important to you to learn math in advance?	83.3	16.7
Parent Q1. Is math important to your child to achieve their professional goals?	76.7	23.3
Parent Q4. Are online courses important to your child to learn math in advance?	81.0	19.0

Questionnaire for Students

Student Question 1. Is math important to you to achieve their professional goals? (Not important, .. , Very important).

Eighty percent of students consider math important to achieve their professional goals.

Student Question 2. Did you like to study math using the "Flipped Classroom" method? Why? (Used to answer research question 1)

All fifteen students answered the question 2, and fourteen students (93.3%) answered that they like to study math using the flipped classroom method. The mainly advantages to use the flipped classroom method were that the students can pause and replay the video as necessary (33.3%), and come to class more prepared (26.7%). Also, other advantages to use the flipped classroom method were that the students can watch the videos at you leisure at home and use the class time to practicing problems. Furthermore, the flipped classroom method gives to the students time to absorb the material, and then they come up with questions to ask the instructor during the traditional class that follows. One student (6.7%) answered that he did not like to study math using the flipped classroom method because no one can answer his questions during the video.

Student Question 3. Are you motivated to study math by "Flipped Classroom" method?

(Used to answer research question 2)

All fifteen students answered the question 3, and twelve students (80.0%) answered that they are motivated to study math using the flipped classroom method. The main motivation to use the flipped classroom method were that the students can replay the video over and over until they understand. (33.3%), and it is easier and a more convenient way to study math (26.7%). Also, other motivations to use the flipped classroom method were the students can learn fast important concepts and examples before the class, and are more comfortable to understand professor explanations in the limited class time. Two students (13.3%) answered that the lack of motivation is because the videos need to be more attractive with more colors, graphs, and pictures. One student (6.7%) answered that he was unmotivated because nobody can explain his questions at home during the video.

Student Question 4. Are online courses important to you to learn math in advance (Before the traditional class)?

About Seventy three percent of the students agree or strongly agree that online courses are important to students to learn math in advance.

Student Question 5. Do you have any comments about this math study or experience? (Evaluate professor, video, flipped classroom method, or anything you want).

Thirteen from fifteen students answered the question 5. Over Twenty one general comments about this math study or experience, 82.0% did positive comments, and 18.0% did negative comments to study math using the flipped classroom method. The most frequent students comments were that the videos are very good technology and flipped classroom method makes the learning easier than the traditional classes (26.7%). Other comments were that the flipped classroom can be use to solve higher math problems and seems to be a promising learning method to reach all students. The flipped classroom can be used to teach math in advance, and solve higher math problem. There are four videos about quadratic equations (Level 1 : Integer Method, Level 2: Quadratic Formula, Level 3: Factoring and Professor Formula, and Level 4: Creativity). The three first videos were at the right pace and good, but the 4th video with creative and more complex questions rushed into thing to fast. The professor is excellent, very clear, and motivates students to learn more and more, but one student reported that the wasn't clear all the time. Some students like the integer method to find fast the solution of the quadratic equations and the creative problems because they are a real challenge. The reasons of lack of motivation were the videos are too hard and need more excitements.

Questionnaire for Parents

Parent Question 1. Is math important to your child to achieve their professional goals? (Not important, .. , Very important).

About eight percent of the parents agree that math is important and 91.7% of the parents agree that math is very important to their children to achieve their professional goals.

Parent Question 2. Did you like that your child study math using the "Flipped Classroom" method? (Used to answer research question 3)

All twelve parents answered question 2, and ten parents (83.3%) answered that they like that their child studies math using the "Flipped Classroom" method. According to parents, the main advantages to use the flipped classroom method were that the videos are very good technology and flipped classroom method makes the learning easier than the traditional classes (25.0%). Also, the flipped classroom method permits their children watch the videos as many times as he wants (25.0%), and it is a easy way to learn ahead (25.0%). Also, other advantages to use the flipped classroom method were that the flipped classroom method is different and interesting way to learn math, more accurate and more efficient than the traditional class, can avoid math anxiety, and seems to be a promising learning method to reach all students. Parents (8.3%) reported that their child refused to watch the videos, and other parents (8.3%) also reported that their child doesn't want to learn math in advance. In particular, one parent commented that “ It made me remember taking math in high school and college, and I didn't understand. Now, watching the videos the topic is easier and interesting”. Also, parents commented that they are eager to see if flipped classroom will spark a love for Math.

Parent Question 3. Is your child motivated to study math by "Flipped Classroom" method?

All twelve parents answered the question 3, and nine parents (75.0%) answered that their children are motivated to study math using the flipped classroom method. The main motivation to use the flipped classroom method were that their children like the idea to study math in advance because he will come to class more prepared (33.3%). Another strong motivation to use the flipped classroom method were that their children were motivated to study math by flipped classroom method in this study because they are seeing quadratic equations at his school, and using videos with different methodologies certainly they will increase his school math performance (25.0%). One parent said that his or her child are motivated to study math by flipped classroom method because he can be familiar with the concepts and examples before the class. In particular, he liked the integer method from the first video because he can solve quadratic equations with integer solutions faster than using quadratic formula. If the solutions are not integer, the method can be used to check the solutions. Another parent reported that his or her son was motivated because he would like to watch more math videos. Few parents (16.7%) justified that they recognized the lack of motivation from their children because their children didn't pay too much attention to the videos. Furthermore, math may not be the most exciting subject for children to spend their time versus play video games or watch TV.

Parent Question 4. Are online courses important to your child to learn math in advance (Before the traditional class)?

The majority of parents agree or strongly agree that online courses are important to their children to learn math in advance (66.7%). The minority, 33.3% of parents were neutral.

Parent Question 5. Do you have any comments about this math study or experience?

(Evaluate professor, video, flipped classroom method, or anything you want).

All twelve parents answered the question 5. Over Twenty-one general comments about this math study or experience, 81.0% did positive comments, and 19.0% did negative comments to study math using the flipped classroom method. The advantage to use the flipped classroom method was that if part of the lecture on the videos is too fast, you can always pause, stop, and rewind back to the part you did not understand or missed while taking notes or working in a problem (25.0%). Another advantage was that flipped classroom method permits kids to learn in advance at home (25.0%). Also, learning math in advance using the flipped classroom is very important because kids develop self confidence and motivate them to learn more. On the other hand, the flipped classroom method can facilitate the professor's life because they need to do the lessons once and can use it many times. Also the lessons are more consistent between classes (If professor is teaching multiple classes). The professor was knowledgeable in his discussion of quadratic equations and methods to solve them. Simple examples were given to illustrate how to use sum and product to solve or check the solutions. Also, the method can incentive students to research videos on youtube.com that students to get more information on a particular math topic. Some parents strongly agree that the videos can prepare students to the class and improve students' math performance, but they need to be more entertaining to keep child's interest in a math high level. The disadvantage of using video is that students may want more than simple writing on a computer screen. For example, add colors, graphs, and pictures to the movies can illustrate the topic and their applications in a real life situations. This way, students will know the importance to study math.

In the discussion chapter, the three research questions will be discussed deeply.

Chapter 5 – Discussions

Fourteen over fifteen students (93.3%) answered that they like to study math using the flipped classroom method. The mainly advantages to use the flipped classroom method were that the students can pause and replay the video as necessary (33.3%), and come to class more prepared (26.7%). Also, other advantages to use the flipped classroom method were that the students can watch the videos at you leisure at home and use the class time to practicing problems. Furthermore, the flipped classroom method gives to the students time to absorb the material, and then they come up with questions to ask the instructor during the traditional class that follows. One student (6.7%) answered that he did not like to study math using the flipped classroom method because no one can answer his questions during the video. One strategy to improve the flipped classroom method for math is to permit that students have the option to watch the videos after school in a computer lab under supervision of a math tutor.

Twelve students over fifteen (80.0%) answered that they are motivated to study math using the flipped classroom method. The main motivation to use the flipped classroom method were that the students can replay the video over and over until they understand. (33.3%), and it is easier and a more convenient way to study math (26.7%). Also, other motivations to use the flipped classroom method were the students can learn fast important concepts and examples before the class, and are more comfortable to understand professor explanations in the limited class time. Two students (13.3%) answered that the lack of motivation is because the videos need to be more attractive with more colors, graphs, and pictures. One strategy to motivate the students to study math using the flipped classroom method is to improve the videos quality using the best computer technology and computer design professionals available.

Teen parents over twelve (83.3%) answered that they like that their child studies math using the "Flipped Classroom" method. According to parents, the main advantages to use the flipped classroom method were that the videos are very good technology and flipped classroom method makes the learning easier than the traditional classes (25.0%). Also, the flipped classroom method permits their children watch the videos as many times as he wants (25.0%), and it is a easy way to learn ahead (25.0%). Also, other advantages to use the flipped classroom method were that the flipped classroom method is different and interesting way to learn math, more accurate and more efficient than the traditional class, can avoid math anxiety, and seems to be a promising learning method to reach all students. Parents (8.3%) reported that their child refused to watch the videos, and other parents (8.3%) also reported that their child doesn't want to learn math in advance. In particular, one parent commented that “ It made me remember taking math in high school and college, and I didn't understand. Now, watching the videos the topic is easier and interesting”. Also, parents commented that they are eager to see if flipped classroom will spark a love for Math.

In general, the flipped classroom method is efficient and attractive solution to learn math in advance because students come to class more prepared. Consequently, the professor has more time to discuss fundamental concepts, real situation applications, and solve more creative math problems. The flipped classroom method is powerful strategy to teach math in advance because the students can watch the videos as many times as they want to full understand each math concepts and their applications. To improve the flipped classroom method for learning math in advance is to permit that students have the option to watch the videos after school in a computer lab under supervision of a math tutor. One strategy to motivate the students to study math using

the flipped classroom method is to use videos with high quality using the best computer technology and computer design professionals available. The next step for this qualitative action research is to do a qualitative action research using the important patterns from student and parent answers as nominal variables to identify correlations with student performance.

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Appendix

Questionnaire for the Students

Please fill this Math Flipped Classroom SURVEY for Students

The purpose of this questionnaire is to examine the viability to teach math using the "Flipped Classroom" method, i.e., learn the lecture online and discuss it in class. Your voluntary participation can contribute to this study by answering only five simple questions (Less than 5 minutes). There is no "right" or "wrong" answer, the responses are confidential, and they will not be used for any other purpose. Please click only one answer for each question, and fill the last essay question. Thank you for participating in my survey.

1. Is math important for you to achieve their professional goals?

1. Not important 2. Kind of important 3. Neutral 4. Important 5. Very important

1 2 3 4 5

Not important Very important

2. Did you like to study math using the "Flipped Classroom" method? Why?

3. Are you motivated to study math by the "Flipped Classroom" method? Why?

4. Are Online courses important for you to learn math in advance (Before the traditional class)?

1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree

1 2 3 4 5

Strongly disagree Strongly agree

5. Do you have any comments about this math study or experience?

(Evaluate professor, video, flipped classroom method, or anything you want)

Questionnaire for the Parents

Please fill this Math SURVEY for Parents

The purpose of this questionnaire is to examine the viability to teach math using the "Flipped Classroom" method, i.e., learn the lecture online and discuss it in class . Your voluntary participation can contribute to this study by answering only five simple questions (Less than 5 minutes). There is no "right" or "wrong" answer, the responses are confidential, and they will not be used for any other purpose. Please click only one answer for each question, and fill the last essay question. Thank you for participating in my survey.

1. Is math important for students to achieve their professional goals.

1. Not important 2. Kind of important 3. Neutral 4. Important 5. Very important

1 2 3 4 5

Not important Very important

2. Did you like that your child study math using the "Flipped Classroom" method? Why?

3. Is your child motivated to study math by "Flipped Classroom" method? Why?

4. Are online courses important for your child to learn math in advance (Before the traditional class)?

1. Strongly disagree 2. Disagree 3. Neutral 4. Agree 5. Strongly agree

1 2 3 4 5

Strongly disagree Strongly agree

5. Do you have any comments about this math study or experience?

(Evaluate professor, video, flipped classroom method, or anything you want)

Informed Consent

Chaminade University of Honolulu

PRINCIPAL INVESTIGATOR: Patrick Chevalier

TITLE OF PROJECT: Learning Math Using the “Flipped Classroom” method for Students from 9th Grade in Hawaii.

PURPOSE: The “Flipped Classroom” is a method where students first watch a video at home (Lecture) , and after they discuss it and do exercises with the professor in class. The purpose of this action research is to test the “Flipped Classroom” method for Students from 9th Grade in Hawaii.

DURATION: There are four videos about Quadratic Equation (Level 1 : Integer Method, Level 2: Quadratic Formula, Level 3: Factoring and Professor Formula, and Level 4: Creativity), two optional questionnaires (One for the students and another for the parents). The total time of the videos are 42 minutes, the students and parents questionnaires take no more than five minutes each, and the optional meeting with the students are estimated to be one hour. The students have one week to see the videos, and the meeting will be on May 13 of 2013. The two questionnaires can be filled until 05/10/13.

PROCEDURES: The parents will receive an email with four videos about Quadratic Equation and an informed consent (Attached). To participate in this study, the students need to watch at least one video, and the meeting and questionnaires are optional. The students and parents questionnaires can be filled easily online.

POSSIBLE RISKS: No risks should be associated with this research, nor is there any direct benefit or compensation for the volunteer participants. Potential benefit for the participant is not only to improve their math background, but also to develop a sense of responsibility and self-learning required in the university level.

CONFIDENTIALITY: The optional questionnaires cannot identify students or parents, and any information from the participants are kept confidential.

HOW THE FINDINGS WILL BE USED: The results of the study will be used for scholarly purposes only. The results from the study will be presented only in my EDUC 793 Final Project.

CONTACT FOR QUESTIONS: If you have any questions or concerns, please contact Patrick Chevalier by phone (808) 375-6201 or e-mail: patrick.chevalier@student.chaminade.edu