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## Effectiveness of Flipped Classroom to Mathematics Learning of Grade 11 Students

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### ABSTRACT

The purpose of this research is to examine the effectiveness of teaching mathematics by using flipped classroom. The participants of this study consist of 42 grade-11 students in mathematics class at Demonstration School of Suan Sunandha Rajabhat University, Bangkok, Thailand. This was taken in the second semester, academic year of 2014. The instruments used in this study include video lectures, worksheets and in-class assignments. The researcher found that flipped classroom encouraged students to be able to manage time in classroom more efficiently and improved their achievement in learning Mathematics at the expected criteria 70 percent. Video assisted students to access and understand the contents with sample problems more clearly. Another strategy, in-class assignments, allows students to have more opportunity to communicate with their teacher. Flipped classroom allows students who can't mark it to some classes be able to catch up to lessons anytime and anywhere. This approach increases opportunities for student engagement which helps students to achieve the course's learning objectives.

*Keywords:* Flipped classroom, Video Lecture, Achievement

### 1. Introduction

Learning circumstances nowadays has changed according to rapidly changing technology. This paradigm shift has resulted in the seeking of new systems and the adjusting and updating of current methods in order to be in accordance with today's ever changing age. Therefore, ideologies, systems, and practices that have been implemented in the past, may be analyzed and reviewed in order to assess the quality and the appropriateness of the results. There is now an important goal for educational institutes to develop and create newer systems to improve learning environment. (Paje,S, 2013)

Traditional learning is when the teacher feeds information and experiences to their students and the main focus is at the teacher. This is a teacher-centered method which is different from the flipped learning method where the methodologies, focus, and energy are given to the learners; individualized competency. The knowledge, skill, concentration, and wisdom given to the individual are self-paced and the teacher assigns various types of work via ICT. In addition, this method of learning is taken place outside the school and gives freedom to the learners to have fun with the learning materials. This has inevitably changed the role of teachers. With that being said, tutors and coaches have emerged as the instigators and facilitators in the classroom. They have created enjoyable activities and suitable learning environment for their learners. Through the use of flipped classroom, a holistic or a mastery of learning is creates. This is also a highly effective method to teach students and kids. This creates cooperation, built confidence, given opportunities for critiques among students. This mastery of learning method shown in the study is to improve the acquisition of knowledge and concepts of 80% of the students whereas if taught with traditional learning, only 20% would have understood the material. (Panich,V, 2013) Characteristics of Mastery Learning according to Tisna Khammani (2010) is that:

1. The instructor defines the objectives and the course content.
2. The instructor plans and strategizes the learning of each individual in full detail in accordance with the course content.
3. The instructor clearly states the goals, outcomes, criterion, rules, and agreements of the class.

4. Learners follow the learning path laid out by the instructor while the instructor gives full attention to each individual student.
5. If the learner reaches the goals set by the instructor, they will follow the next processes.
6. If the learner reaches the goals set by the instructor, the instructor must reevaluate and assess the learning methods of the learner and must devise a program to accommodate the other learners that have not met the goal.
7. The learner continues on the learning path set by the instructor and achieves the set goal. Each learner learns at different speeds.
8. The instructor follows up with the learning of each student in accordance with the goals and objectives set. The instructor will give individual assessment and will use prior data to map out course plans while maintaining a flipped classroom.”

The new methods of learning have these four characteristics (Schoolwires, 2013);

1. **Experiential Engagement** – involving the instructor guiding the learners to learn through various activities creating new experiences through mock scenarios, experimentations, or other creative outlets.
2. **Concept Exploration** – involving the instructor sharing new outlets of learning via Podcasts, websites, online chats, or other multimedia channels.
3. **Meaning Making** – involving the learner creating content and learning material on their own through the use of blogs, tests, social networking, and discussion boards.
4. **Demonstration and Application** – involving the creative creation of knowledge by the learner through the execution of projects, and presentations. The use ubiquitous computing, technology, micro processors, mobile phones, digital cameras, and other technological tools to create a connected learning environment and follows the 3 A’s; anyplace, anytime, anywhere. “Learning in any location and at any time, creates a ubiquitous society. (Brahmawong, C, 2011)”

### 1.1 The Flipped Classroom Model

The “flipped classroom” is a new catch phrase in education, but is not a completely novel idea. Teachers often assign students’ reading to be done at home, and then expect students to engage in conversation about the reading they take in class. This design could be classified as an inverted classroom (Strayer, 2012). However, a few key characteristics distinguish the flipped classroom from an inverted classroom. In the flipped classroom, students watch video-recorded lectures outside of class, thus increasing time for active learning and practice to occur in class (Strayer, 2012). While implementation of this method may look slightly different for each teacher, essentially “the ‘flipped’ part of the flipped classroom means students watch or listen to lessons at home and do their ‘homework’ in class” (Fulton, 2012, p. 13).

Online learning has various definitions. Historically, video lectures were created to provide curriculum access to individuals who lived far from school. Teachers began realizing that videos not only helped off-site students, but also students who were present during lectures (Cascaval, Fogler, Abrams, & Durham, 2008). Online classes gained popularity in the past decade, especially at the college level. However, students commonly complained about limited interaction and communication in purely online classes (Gecer & Dag, 2012). Flipping the classroom involves online learning through a series of video lectures, but is supported by face- to-face classroom discussions and individual help. Thus, the flipped classroom is different from traditional online learning environments.

Traditional classroom lectures often follow a one-pace-fits-all philosophy. Teachers may adjust their lectures based on student feedback, but some students will undoubtedly find the pace swift, while others find it slow. Video lectures provided through the flipped classroom model allow students to fast forward through examples they already understand, or pause and rewind to revisit topics which may require more processing time (Goodwin & Miller, 2013). Videos allow lectures to be broken into pieces, as opposed to traditional instruction which often contains a large volume of content delivered at one time (Brecht & Ogilby, 2008).

Salman Khan, a widely recognized online educator, popularized the flipped classroom through his website, Khan Academy. This website contains over 4,120 short educational videos, most detailing a specific math concept (Thomas, 2013). Khan works problems step by step on each video. “Khan’s idea was that youngsters would watch the videos at home and work on problems in class, essentially ‘flipping’ the classroom” (Kronholz, 2012, p. 25). Students also frequent the website to get homework help when they are

stuck on a problem. Khan seeks to change the way people think about education, noting “the old classroom model simply doesn’t fit our changing needs” (Khan, 2012, p. 1).

Many schools have used Khan’s videos to flip the classroom. Greg Green, principal at Clintondale Community Schools in Michigan, commended the flipped classroom for its ability to assist students who do not get homework help at home (Finkel, 2012). Students now receive guidance at home in the form of video lectures, and can directly interact with teachers and peers during class time to get answers to their questions. Teachers utilizing Khan Academy to flip their classrooms realize they often work harder during the school day as they are always moving around and interacting with students. It must be noted Khan Academy is not meant as a fix-all. Math teacher Courtney Cadwell commented Khan “is not great at helping kids conceptualize math” (Kronholz, 2012, p. 26). Video lectures need to be supplemented with activities which encourage discussion and emphasize the application side of mathematics. When flipping the classroom, teachers must constantly interact with students, adjust instruction on the fly, and design activities which complement the videos.

In this study, the researcher employed flipped classroom in order for students to watch video before studying in class. According to this strategy students have more interaction with teachers with a variety of activities. Moreover, flipped classroom provides students especially absent students for reviewing lesson anytime. Therefore, this strategy helps students have increasing achievement and positive attitude in mathematics.

## 1.2 Research Objective

This research aimed to enhance student achievement in mathematics. The following statements were assigned as research objectives:

To study the effect of teaching using flipped classroom model in mathematics classroom of 11- grade students.

## 2. Methodology

### 2.1 Participants

Participants in this study were 42 Grade-11 students. The study was taken in the second semester of the 2014 academic year at Demonstation School of Suan Sunandha Rajabhat University

### 2.2 Instruments

The following instruments were used in this research:

- 1) Five Lesson plans in the topic of “Statistics”.
- 2) Achievement tests to the topic.
- 3) Questionnaire used to explore students’ satisfaction towards using a Flipped Classroom with five-point Likert scale.

### 2.3 Data Collection

This research was performed as followed

- 1) The researcher prepared the content in teaching.
- 2) The researcher developed 5 lesson plans using the flipped classroom model.
- 3) The researcher explained the flipped classroom to the students.
- 4) The researcher taught students in accordance with the prepared lesson plans. The estimate time is 10 periods.
- 5) The students were assigned to complete the questionnaire.
- 6) The students took the achievement tests.

### 2.4 Data Analysis

1. The learning effectiveness was analyzed from post-test points by using a paired-sample t-test with the significance level at 0.05
2. The researcher evaluated students’ satisfaction from questionnaire by using descriptive statistics, mean and standard deviation.

### 3. Results

Achievement in mathematics after using the flipped classroom is to have scored criteria at 70 percent.

Table 1

*Student's achievement in mathematics after using the flipped classroom*

Student achievement	N	Mean	70 percent of point(s)	S.D.	t	df	Sig
Test(total point(s) = 10)	42	8.17	7	1.56	4.79	41	0.00

One sample t-test was conducted to compare achievement in mathematics after using the flipped classroom at the expected 70 percent criteria. The results shows the mean of points,  $M=8.17(SD=1.56)$  more than 7 points. As stated in table 1, a significant difference was found  $t(41)=4.79, p<0.05$ , which revealed that the achievement in mathematics after using the flipped classroom was significantly higher than the expected 70 percent criteria.

Table 2

*Student's attitude towards using flipped classroom.*

Statement	Mean( $\bar{x}$ )	S.D	Level
1. The video lectures helped me understand math concepts.	4.40	0.63	High
2. I would rather watch a video lecture for homework than do math problems for homework.	4.62	0.49	High
3. When the classroom was flipped, I spent more time working with classmates.	4.50	0.55	High
4. I understand the problem sets (worksheets) better when I work with a classmate.	4.71	0.46	High
5. The flipped classroom allowed for more time to ask the teacher questions in class.	4.62	0.49	High
6. The flipped classroom allowed more time to complete problem sets (worksheets) in class.	4.31	0.60	High
7. When the classroom was flipped, I understood the problem sets (worksheets) better.	4.69	0.47	High
8. I was more engaged watching the videos than I was during in-class lectures.	4.21	0.56	High
9. I watched the video lectures prior to class.	4.28	0.55	High
10. I often paused the videos when watching them in order to process the content.	4.50	0.51	High
11. I rewound some videos or watched them more than once.	4.21	0.65	High
12. I fast forwarded the videos when watching them.	4.28	0.67	High
13. When I watched the videos, I took notes.	4.31	0.60	High
14. I am able to focus better when the lecture is broken into smaller parts.	4.12	0.55	High
15. I want to continue learning math in the flipped classroom format.	4.21	0.47	High
Total mean	4.40	0.38	High

Table2 shows that mean of student's attitude towards using flipped classroom ( $\bar{x}=4.40, S.D. = 0.38$ ) was high level. The highest mean points for item 4 and 7 respectively are as followed: 1) I understand the problem sets (worksheets) better when I work with a classmate ( $\bar{x}=4.71, S.D. = 0.46$ ); 2) When the classroom was flipped, I understood the problem sets (worksheets) better ( $\bar{x}=4.69, S.D. = 0.47$ ) flipped classroom helped student knowledge in statistics.

#### 4. Conclusion and Discussion

In this research teaching mathematics using the flipped classroom model was performed under the selected topic (statistics). This method applies to 42 grade-11 students.

The results conclude that the flipped classroom help to develop student achievement in mathematics by learning with a variety of model activities such as video files and handouts.

Most students have positive attitude towards the flipped classroom. They agree that the Flipped Classroom assists them to be able to learn mathematics more effectively. Moreover, they have more opportunity to communicate with their teachers and classmates.

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