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IMPLEMENTATION OF FLIPPED LEARNING STRATEGY IN MATHEMATICS AT A SECONDARY SCHOOL IN INDIA: A CASE ANALYSIS

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Abstract

Flipped Learning Strategy is a concept wherein the students are provided the first exposure to the concepts through the instructional videos which they are instructed to watch at home so that the in-class time is freed for engaging the students in various student- centered activities. Though numerous benefits of flipped learning in higher education have been reported, the benefits of flipped learning at K-12 need to be examined. Thus an exploratory case analysis of implementation of Flipped Learning Strategy in Mathematics at a Secondary School in India is conducted. Many benefits and challenges have been recorded and reported in the study so that an appropriate flipped learning classroom design can be developed to reap the benefits and overcome the challenges.

Keywords*: flipped learning, secondary education, mathematics, K-12 setting, benefits and challenges*

Introduction

Flipped learning Strategy is a technology driven method of teaching in classrooms that emphasizes peer-instruction and deep learning (Abeysekera & Dawson, 2015; Bishop & Verleger, 2013). The first exposure to the content is given to the students through the mini-video lectures before the face to face class. This helps to recuperate the class time for the active learning student-centered activities (Bishop & Verleger, 2013; Lo, Hew, & Chen, 2017). Now-a-days Flipped learning strategy is increasingly being used around the world due to its plethora of benefits like personalized learning (Davies et al.,2013), better engagement (Butt, 2014) and better performance (Tune et al., 2013).Though numerous studies have been

conducted on flipped learning in various disciplines, Lo et al. (2017) found that very few studies have been conducted in mathematics subject at secondary school level.

Objective of the Study

It is evident from the literature that implementation of Flipped Learning Strategy does possess positive impact yet its impact in K-12 mathematics remains unexplored. Thus this study was done to explore the benefits and challenges of Flipped Learning Strategy in Mathematics at secondary school in India.

Research Objectives

1) To study the benefits and challenges of the 'before class stage' of Flipped Learning Strategy in Mathematics at secondary school in India.
2) To study the benefits and challenges of the 'during class stage' of Flipped Learning Strategy in Mathematics at secondary school in India.
3) To study the benefits and challenges of the 'after class stage' of Flipped Learning Strategy in Mathematics at secondary school in India.

Research Questions

1) What are the benefits and challenges of the 'before class stage' of Flipped Learning Strategy in Mathematics at secondary school in India?
2) What are the benefits and challenges of the 'during class stage' of Flipped Learning Strategy in Mathematics at secondary school in India?
3) What are the benefits and challenges of the 'after class stage' of Flipped Learning Strategy in Mathematics at secondary school in India?

Method

Participants

Total 34 students of Class IX A, from DAV Public school of Hilltop Colony, Brajrajnagar were selected as per the non-random technique of sampling. This convenience sample included the individuals, accessible to the researcher. This sample further consisted of 19 girls and 15 boys.

Materials and procedure

A topic- Surface Area and Volume of the cube and cuboid from NCERT class IX textbook was taught to the class using Flipped Learning Strategy through BEFORE CLASS STAGE, DURING CLASS STAGE and AFTER CLASS STAGE design. For 'before class stage' activities, a Google Classroom was created for Class IX students for this study and a mini-

video related to the topic –surface area and volume of the cube and cuboid that was earlier downloaded from the Khan Academy website was uploaded in this Google Classoom and the students were asked to watch and come prepared for the face to face class next day. Again, an assignment consisting of two questions on surface area and volume of cube and cuboid was uploaded in the same Google Classroom. The students were asked to answer the questions in their Mathematics notebook. The next day in 'during class stage', for the first five minutes students were quizzed on their knowledge on surface area and volume of cube and cuboid. Then they were instructed to solve the exercise on the same topic from NCERT class IX textbook. While solving the problems they had the freedom to discuss the same with their partners beside them. The teacher-researcher then moved around the classroom and facilitated the students in case of any doubts or queries. It took two days to complete the exercise in the classroom. For 'after class stage' of Flipped learning strategy, students were asked to pose at least two questions by themselves and they were even instructed to answer those questions independently and submit the very next day. A short test on surface area and volume on cube and cuboid was given on the last day of the study. The study was conducted for a week and the students were asked to maintain a journal (a notebook of 25 pages) everyday that was initially distributed by the researcher wherein the students had to note down their experiences on benefits and challenges about the 'before class stage', 'during class stage' and 'after class stage' of Flipped Learning Strategy to gain insights of the benefits and challenges of the aforementioned stages of Flipped Learning Strategy at secondary school in India. These journals were collected by the researcher at the end of the study.

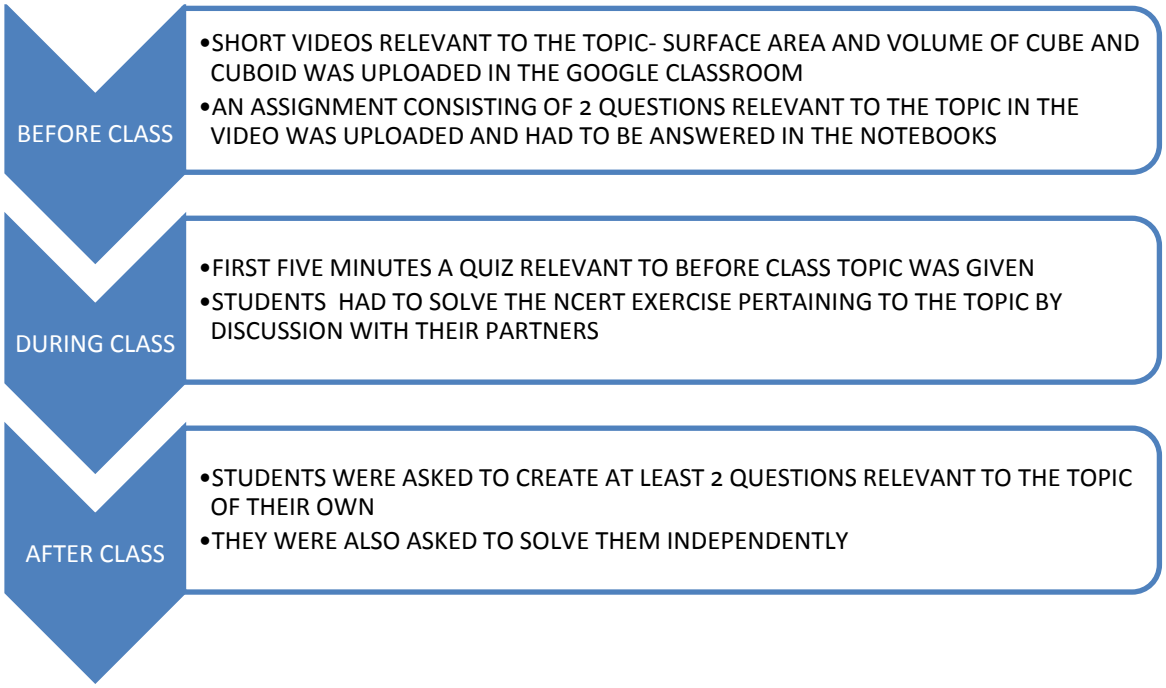

Figure 1: Diagrammatic representation of 'Before Class Stage', 'During Class Stage' and 'After Class Stage' of Flipped Learning Strategy

Data Analysis

The Journals of the students were analyzed using qualitative data analysis procedures given by Creswell(2012). Thematic analysis was particularly done for this study. At first coding was initiated that is different codes were generated for different pieces of data captured in the students' journal. These sometimes even comprised of students' exact wordings. After the completion of coding of the data from the first journal, the codes were reviewed thoroughly by the researcher and regrouped carefully. Then the redundant codes were eliminated and a preliminary list of data was developed. Further the data present in rest of the students' journals were analyzed based on this preliminary list of codes and emerging codes that could enrich this list were identified. Thus themes were successfully created for the study that have been highlighted in the result section.

The Results

(1) Dimension 1: The benefits and challenges of the 'before class stage' of Flipped Learning Strategy at secondary school in India

From the students' journals, five important themes developed regarding the 'before class stage', namely self-paced mini-video lecturing, quick revision before test, better

understanding of concepts via videos, lack of access to videos, doubts remained unanswered

(i) self-paced mini-video lecturing

As quoted by a student: "I can watch the videos and can take down the notes slowly…if I don't understand something I can re-watch and rewind until I get it."

(ii) quick revision before test

One of the students stated "It is easier and quick to revise the concepts for the test via video than the textbook"

(iii) better understanding of concepts via videos

In the words of one student "After seeing the 3d shapes of cube and cuboid and how this is formed in video, I can now understand the formula of surface area and volume of cube and cuboid."

(iv) lack of access to videos

One student remarked "Though I have a computer at home but due to bad internet I could not watch the video."

"I neither have a computer nor have a mobile so I could not watch the video given by you"

(v) doubts remained unanswered

A student recalled "After I watched the video and was doing my assignment I had some doubts and needed some help"

(2) Dimension 2: The benefits and challenges of the students of the 'during class stage' of Flipped Learning Strategy at secondary school in India

When the students' journals were analyzed for the benefits and challenges about the 'during class stage' of the Flipped Learning Strategy the following themes were discovered- formative assessment, increased peer interaction, sharing and helping each other, active participation, timely guidance by teacher, recapitulation required, proper orientation desired and academic loss for unprepared students, finding difficult to adjust to new teaching strategy.

(i) formative assessment

One student mentioned "I liked to participate in the quiz…it helped me realize what I know and what I need to know more about the topic"

(ii) increased peer interaction

A student wrote "I discussed the maths problems with my friends that helped me understand the problem better and perform better"

(iii) sharing and helping each other

A student shared "My classmates helped me to identify my mistake while solving a problem today…I am feeling confident now"

(iv) active participation

A student stated "Today I tried to solve the exercise problems and discussed with my friend and teacher when I was not able to do it. This flipped class made my lessons easy"

(v) timely guidance by teacher

In the words of one student "You always helped me when I was not able to understand something"

(vi) recapitulation required

One student remarked "I watched the video you had sent but I don't remember the formula…teacher please make us revise before solving the exercise"

(vii) proper orientation desired

A student mentioned "I was confused about this method of teaching…when to do what"

(viii) academic loss for unprepared students

A student wrote "I could not watch the video yesterday so I didn't understand how to solve the exercise"

(3) Dimension 3: The benefits and challenges of the 'after class stage' of Flipped Learning Strategy at secondary school in India

The students' journals were further used for the analysis of their benefits and challenges about the 'after class stage' of Flipped Learning Strategy. The following themes were identified, namely 'posing questions', 'problem-solving increased competence', 'more challenging questions desired'.

(i) posing questions

As quoted by a student "Making questions all by myself was a new thing for me and I found it very interesting"

(ii) problem-solving increased competence

A student remarked "Everytime I made my own question and solved it myself I felt more confident about the topic"

(iii) more challenging questions desired

A student wrote "More challenging questions from outside the textbook should be discussed so that we get more variety of questions to be practiced and become expert in solving any question from the lesson"

Conclusion and Discussion

In this study, the benefits and challenges of the 'before class stage', 'during class stage' and 'after class stage' of Flipped Learning Strategy in Mathematics at secondary school in India were explored. If was found that the students were immensely benefitted with this innovative strategy of teaching namely Flipped Learning Strategy like the students were could re-watch the videos to take notes , the struggling students could rewind the video to understand the concept, active participation in the class and solving the problems with the help of their peers helped them boost their confidence and posing questions promoted their creativity yet they faced a few challenges like problem in accessibility to the instructional video and their doubts while before class stage remained unanswered. These findings are discussed in the following section. The benefits of 'before class stage' of Flipped Learning strategy like self-paced mini-video lecturing, quick revision before test resonates with the findings of Lo et al(2017). Even the finding of this study- better understanding of concepts via videos as stated by students is reflected by the students in the study of Clark (2015). Abeysekera and Dawson (2015) even supported the idea of self-paced mini-video lecturing and added that it could prove helpful to students to manage the cognitive load. The students in this study recognized and valued the idea of 'sharing and helping each other' as reflected in the study of Larsen (2015). The challenges faced by the students like bad internet problem and doubts of the students during 'before class stage' remained unanswered were mirrored in the findings of Gunduz & Akkoyunlu (2019).

Limitations and Recommendations of the Study

There are several limitations in the study. First of all, the study was conducted for mathematics so it cannot be predicted that same results will be obtained for other subjects. One of the limitations of the study was that it was conducted in a K-12 set up. The study can be conducted in mathematics in higher education and students' opinions can be recorded and even a comparison can be made between the two settings. Even more questions could be

added for better insights of the benefits and challenges of the Flipped Learning Strategy in Mathematics.

This is just a preliminary study. More indepth studies need to be carried out so as to add to the literature regarding the implementation of Flipped Learning Strategy especially in the Asian context.

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