

Assessment of Flipped Classroom uses for Engineering Mathematics

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Abstract Flipped Classroom is a tutorial strategy and a form of combined studying which offers significance to being taught using instructional content outside the lecture hall rather than traditional environment. It often makes use of on-line learning. Students watch online lectures and discuss online also, after having the activities done, they interact with their teachers in the lecture hall. In Flipped Classroom, instead of doing traditional homework, students are given to do activities. The room of the flipped school for math coaching can be most suitable as it may be that the parents do not have the ability to train their wards on some mathematical problems operated within the class room with the teacher. In traditional faculties, uniformly difficult and fast quantities are received in all subjects for all students. Hence, the investigator is accomplishing an experiment study on Flipped classroom on mathematics teaching. Under the RGPV University's syllabus, tests conducted on engineering students at the IPS Academy in Indore show that the Flip lecture hall has undoubtedly influenced engineering mathematics. The investigator being a mathematics instructor himself organized a video lesson on differentiation one of the topics in engineering mathematics.

Keywords- Effectiveness, Flipped class-room, Mathematics, Engineering, learning, Teaching.

I. INTRODUCTION

New technologies are frequently presented for Educators which have the ability to assist students for acquiring knowledge. Flipped Class is a new concept that has recently gained place in every popular and scientific instructional literature. It describes a method whereby the college students are provided with educational materials through online learning environments. Classroom is used for learning-focused activities which create by traditional teachers on pre-classroom work instead of lecture period.

In America, science teacher John Bergman and Aaron Samams decided to use video-recorded lectures for their students who missed the class. They found that students were generally in favor of this technique. They also experienced that this technique allowed more effective use of class time and motivated the students to learn themselves. In recent years, the concept has expanded and the flipped class approach has been reported in various types of educational settings, including engineering mathematics.

In the flip learning model, students give time to learn about new concepts rather than giving time in their regular 'homework'. Flipped Classroom is an instructional strategy that often overturns the traditional learning environment by delivering instructional content online outside the classroom. In traditional schools, every subject in the classroom takes place at a fixed time for all students. But

flipped classrooms allow each student to choose the time at their convenience. Traditional schools was impractical, students who initially used to perform poorly, should have been corrected before proceeding, but this was not happening. It was not possible to give different lectures for different groups of students. Testing was also impractical, because the fast-educating students could reveal the test to those who followed. In a flipped class, students look at each lecture and work on each practice or project unless they are mastered.

Flipped master finishes two other out-of-class routines: Daily Text Planning and Grading Paper Classroom activity increases in place of lectures with group and individual activities. Every student has to do something in the whole class. In some classrooms, students choose how to demonstrate excellence, testing, writing, speaking, debate and even designing related exams. Moodle provides a way to manage the testing process. It creates a separate test for each student from the pool of questions.

Advanced students work on independent projects, while slow learners get more personal instructions. Some students may not be able to get through the material of the year, but they demonstrated ability on those parts which they had accomplished.

II. PURPOSE OF THE STUDY

Despite a whole lot discussion inside the literature, there are few studies that use objective evaluation of scholar

performance to measure the impact of a flipped study room technique. The flipped classroom has proven potential in mathematics education; studies that have looked at scholar overall performance in an engineering course recorded an improvement in examination results with a flipped classroom approach. The purpose of this study was to assess the use of a flipped classroom approach within an engineering course. The Study has been attempted with the following goals:

- Evaluate student perceptions of a flipped class room in contrast to a conventional, lecture-based course.
- To develop a video lesson on engineering mathematics as per RGPV, Bhopal syllabus.
- To prepare a criterion test on engineering mathematics
- To find out the effectiveness of Flipped classroom on engineering mathematics

To the authors' knowledge, this is the first time that use of the flipped classroom in engineering mathematics

III. ADVANTAGES OF THE FLIPPED CLASSROOM

One of the primary advantages proposed for the flipped classroom is that

- It creates possibilities for learners to access information at a time and location of their choosing.
- If recorded lectures are used, then they can be stopped and released again; thus, the learners can move through the material at their own pace.
- This technique allows learners to access sources of material repeatedly.
- Another proposed benefit of a flipped class is that it allows faculty and college students to make better use of face-to-face time.

Many students and teachers agree that the Flip Room is a valuable way to increase the level of learners and promote their sense of responsibility. Apart from this, research proposes that the teaching approach improves their academic performance.

IV. DISADVANTAGES OF THE FLIPPED CLASSROOM

There are many drawbacks in the approach of flipped class:

- Most of the experiments have been done in urban centers, students of rural areas have not been included in the study.
- In the flipped class, learners are encouraged to learn from themselves, but this is possible only when they are ready and able to do this.
- Educators who are not familiar with Flip Class also require assistance because they have the responsibility of creating different types of pre-class content and assignments,
- Migration from traditional lectures to flipped classes will also increase the workload of teachers, which many teachers have expressed their concern about.

The cost of building content for classes will also increase, though this is a one-time startup expense, because the video and activities can be reused and updated over time.

V. HYPOTHESIS FORMULATED FOR THE STUDY

Following hypothesis formulated for the study:

"There is no significant difference between flipped classroom design and the traditional lecture style classroom in terms of student performance and student satisfaction in the classroom of Engineering Mathematics".

VI. METHODOLOGY

In this study, the students studying in IPS Academy Indore under RGPV University, Bhopal were examined for the use of classroom approach flipped for engineering mathematics. In 2018, a traditional, lecture-based business skill course, "Engineering Mathematics I" took a new look. Traditional big group lectures on different types of subjects were replaced with a flip class approach. In this later approach, two major educational components were included:

I. Pre-Class Activities: Before the class start-up, the teaching material was presented to the students through online medium, in which many components related to the subject were included:

- A list of learning outcomes,
- A written article
- PowerPoint lectures, and
- Multi-choice quiz

The online course work was designed so that students did not take more than 30 minutes to complete it. One week before the class, students were given pre-classroom activities and after that it was freely accessible.

II. In-class activities: The class was introduced with a brief discussion of online pre-class work and observation of topics. The remaining time was dedicated to active teaching practice, in which the group's activities were involved. The duration of each period was one hour. Student activity was also documented during class.

6.1 Sample

The sample comprised of 298 students, whose details are displayed in the following table:

Cohort	Male	Female	Total
July–December 2017	90	29	119
July–December 2018	152	27	179
Total	242	56	298

TABLE_1. Sample of two cohorts

The sample consisted of two cohorts of students: July–December 2017 cohort and July–December 2018 cohort. There were 298 students (242 males, 56 females). No statistically significant difference in overall academic performance between the two cohort students. Students participating in the study signed a written document which was used to maintain the confidentiality of students and assurances that data received from the study will be presented only in the research output.

6.2 Instruments

The Course Evaluation Questionnaire, which has 25-item survey instrument, was used to explore student perceptions of their classroom experience.

TABLE_2. Scale point for evaluation

Scale Point	Description
1	Strongly disagree with the statement
2	Disagree with the statement
3	Neither agree nor disagree
4	Agree with the statement
5	Strongly agree with the statement

Each item on the questionnaire was answered using a 5-point scale ranging from a score of 1 to 5, as describe in the table 2.

All analyses were carried out in the open source statistical software R, using packages “likert” and “plyr”.

6.3 Statistical analysis

At the end, 96.3% (287 out of 298) students in the flipped classroom submitted course evaluations.

Cohort	Male	Female	Total
July–December 2017	87(96.6%)	27(93.1%)	114(95.7%)
July–December 2018	147(96.7%)	26(96.2%)	173(96.6%)
Total	234(96.6%)	53(94.6%)	287(96.3%)

TABLE_3 Percentages of participation

First, the data obtained from the CEQ was analyzed to determine the internal stability of the responses. Thereafter, the item was analyzed to check the reliability and validity of the test. Difficulty levels of testing items and discriminatory indices were found in item analysis. Differences in responses between cohorts to individual items were analyzed. Written examination was held in the form of multiple choice questions, in which the performance performed by students was compared between cohorts. Both the total number of correct multiple-choice items and correct results grouped by knowledge and

application type were analyzed as the exam results were non-normally distributed. In the table given below compares the responses given by students of both cohorts.

It is evident from table 4 that the Flipped Classroom has positively affected the students’ achievement in Engineering Mathematics.

VII. RESULTS AND DISCUSSION

In the student survey conducted in two flip cohorts, students responded positively for flip class-room. Student's comments indicated that education was more personal, and online resources gave students greater control over their learning. The analysis of students' performance on quiz and exam averages is presented in following figure:

	July–December 2017		July–December 2018	
Strongly disagree that they would recommend the course to others	6.1% (07)		5.2% (09)	
Disagree that they would recommend the course to others	4.3% (05)		5.7% (10)	
Neither agree nor disagree	7.01% (08)		3.4% (06)	
Agree that they would recommend the course to others	42.9% (49)	82.4% (94)	53.3% (79)	85.5% (148)
Strongly agree that they would recommend the course to others	39.4% (45)		46.6% (69)	

TABLE_4. Cohort wise data analysis

A total of 298 students agreed to participate in the study, out of which 287 students completed both CEQ and written examination. It represents the overall participation rate of 96.3% (96.6% male students and 94.6% female students). Of which 82.2% (July–December 2017 Cohort) and 85.5% (July–December 2018 Cohort) voted in favor of Flip Class room instead of the traditional class room.

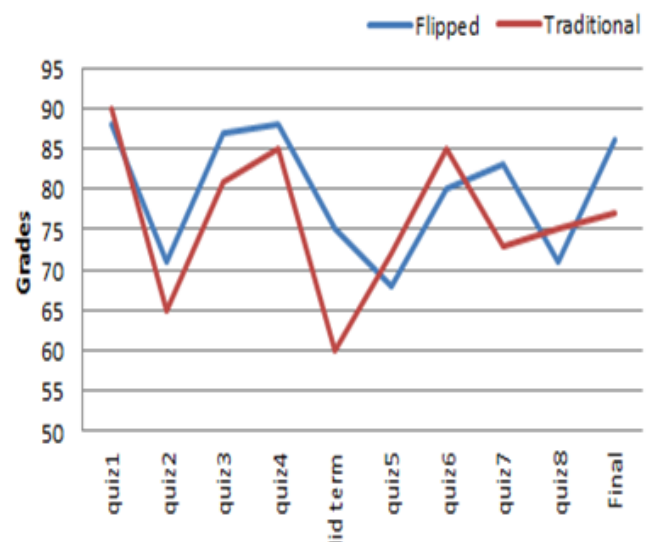


Fig. 1Diference between traditional and flipped classes

VIII. EDUCATIONAL IMPLICATIONS

This study has shown that flipped classes have improved the achievement of students in mathematics. Therefore, teachers of mathematics can be trained to create online learning materials such as video, PowerPoint presentation etc. on math units and it can be allowed to send students through modern mediums such as WhatsApp, Face-book and Website etc. Students can learn lessons at home. In practical terms, it has helped a lot for the students. Especially for those students whose parents are uneducated and may not be able to support their children at home in doing homework. It will also be a great help to the student community and society in mathematics.

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