

Flipped Classroom Strategy to Improve Students' Learning of Computer Communication Network: An Experience Report

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Abstract: Like all technologies, new teaching technologies can be used in teaching. Traditional teaching helps in memorizing the things. It is found that teaching with active learning strategies will improve students' learning level. Flipped classroom is an active learning strategy that reverses the traditional learning environment. This paper discusses the Flipped classroom concept applied for teaching subject Computer Communication Network. For this study, we considered two group pre-post test method. The Flipped classroom method improved student's learning. The students who underwent Flipped classroom treatment found to have more clear understanding of the topic compared to the students learnt topic with traditional teaching. We also presented the feedback and results about the Flipped classroom.

Keywords: control group, experimental group, traditional teaching, Flipped classroom, learning.

1. Introduction:

Educational leaders and researchers agree that teachers have an immense impact on student success. An analysis from the Texas Schools Project, found that teacher quality differences explain the largest portion of the variation in reading and math achievement. Other research has shown that an ineffective teacher can impact student learning for reading and math achievement. Other research has shown that an ineffective teacher can impact student learning for years. The teacher needs to understand the teaching skills that are objectively proven to impact a teacher's success in the classroom. Here one of the teaching skills that are Flipped Classroom has found successful to improve student learning level such as, creating a learning environment, delivering effective instruction and application of a concept.

Highly effective instruction requires a strong understanding of a given subject or concept in addition to the understanding of how to best deliver the lesson for that subject. In order to deliver successful instruction, student needs to provide differentiated learning opportunities. Different pedagogical practices need to be incorporated to check students understanding. Students should feel engaged in the lesson and have the opportunity to absorb information based on their learning style. Once the instructor notices that a student may benefit from a different learning style. The instructor should provide the appropriate type of task and check for understanding. It's important to provide the best learning experience for both teacher and student. There should be a strategy which keeps the students

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engaged. Creating a learning environment, delivering effective instruction and analyzing and adjusting, they are one step closer to identifying and hiring highly effective teachers and offering their students the best chance to succeed.

2. Related work:

Instructors and professors at many universities, including the University of British Columbia, the University of Memphis, the University of North Carolina, Chapel Hill, Texas A&M University, Capital University, Georgia Institute of Technology and Harvey Mudd College have started incorporating elements of the Flipped Learning model into their classes. (J. Yarbrow et al., 2013) outlines the empirical evidence from these endeavors, documenting the impact Flipped Learning has on student achievement and engagement.

The ability to engage students and develop critical-thinking skills is presented in (C. F. Herreid and N. A. Schiller, 2013). Kathleen Fulton (Kathleen Fulton, 2012) listed the advantages of the flipped classroom:

- (i) Students move at their own pace.
- (ii) Doing "homework" in class gives teachers better insight into student difficulties and learning styles.
- (iii) Teachers can more easily customize and update the curriculum and provide it to students 24/7.
- (iv) Classroom time can be used more effectively and creatively.
- (v) Teachers using the method report seeing increased levels of student achievement, interest, and engagement.
- (vi) Learning theory supports the new approaches
- (vii) The use of technology is flexible and appropriate for "21st century learning."

Pitfalls of the flipped approach reported by (Kathleen Fulton, 2012) are

- (i) Students new to the method may be initially resistant because it requires that they do work at home rather than be first exposed to the subject matter in school. Consequently, they may come unprepared to class to participate in the active learning phase of the course.
- (ii) The homework (readings, videos) must be carefully tailored for the students in order to prepare

them for the in-class activities.

B.B. stone (2012) reported that there is an improvement in students learning. Flipping did not have any negative impact on attendance. Positive impact of flipping is reported by the author.

3. Methodology:

A. Objectives:

The objectives of Flipped classroom are

- To clear the concepts of error detection and correction protocols
- To apply the knowledge for detecting and then for correcting errors in the transmitted bit stream.

B. What is Flipped Classroom?

Flipped Learning is a pedagogical approach in which direct instruction moves from the group learning space to the individual learning space, and the resulting group space is transformed into a dynamic, interactive learning environment where the educator guides students as they apply concepts and engage creatively in the subject matter [<http://www.uvm.edu/ctl/resources-teaching/Flipped-classroom/>].

Flipped classroom is an instructional strategy and a type of blended learning that reverses the traditional learning environment by delivering instructional content online, outside the classroom. The activities traditionally been considered homework are done into the classroom. In a Flipped classroom, students watch online lectures, collaborate in online discussions and engage in concepts in the classroom with the guidance of a mentor [https://en.wikipedia.org/wiki/Flipped_classroom].

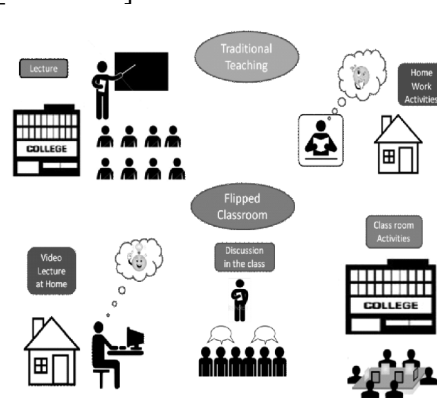


Fig. 1: Flipped Classroom

C. Traditional vs. Flipped teaching:

In the traditional model of classroom instruction, the teacher is the central focus of a lesson and the primary disseminator of information during the class period as shown in fig. 1. In a classroom with a traditional style of instruction, individual lessons may be focused on an explanation of content utilizing a lecture-style. Student engagement in the traditional model may be limited to activities or task designed by the teacher. Class discussions are centered on the teacher, who controls the flow of the conversation (Ryback, D. & Sanders, J., 1980).

The Flipped classroom intentionally shifts instruction to a learner-centered model in which class time explores topics in greater depth and creates meaningful learning opportunities, while educational technologies such as online videos are used to deliver content outside of the classroom. In a Flipped classroom, content delivery may take a variety of forms. Often, video lessons prepared by the teacher or third parties are used to deliver content, although online collaborative discussions, digital research, and text readings may be used (Abeysekera et al., 2015, Ronchetti, 2010 & Greg Topp, 2011). Students will have discussions, activities in the class; based on the videos lessons learned outside the class.

4. Experimental Detail:

A. Experimental set-up:

The Flipped classroom strategy is implemented for final year engineering students for the subject computer communication network. The challenge to the students in the subject is to remember number of protocols. Students can apply the error detection and correction techniques when students understand it. The level higher than recall in bloom's taxonomy (from recall to apply) is achieved through Flipped classroom.

The experiment is carried out for a group of 36 students. These 36 students underwent a prior knowledge test on the topic which is already conducted in classroom. Based on prior knowledge test, group of 36 students are divided into equal group of 18 students. Thus 2 groups are formed which contained equal mental ability of students. The groups formed are called, control group and experimental group.

B. Research Design:

The research design flow as shown in fig. 2

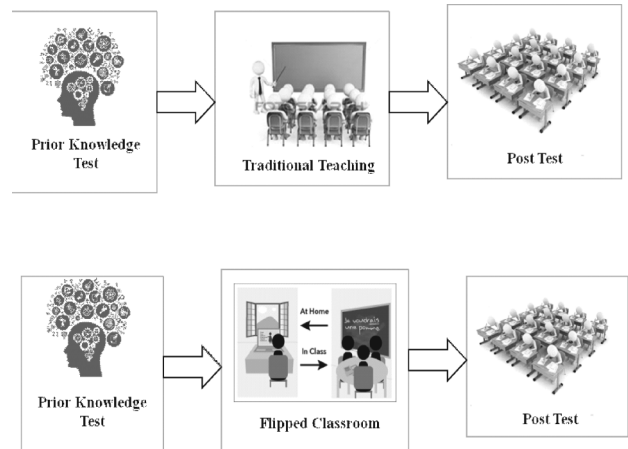


Fig. 2: Research Design

Control group is treated with traditional teaching for the topics on error detection and correction protocols. Whereas, to the experimental group is provided with the videos on the topic and allowed them to go through the videos. The student can watch and rewatch the videos till they understand it. I want to thank Dr. Kameshwary Chebroulu for providing us her recorded videos on Computer Networking. The videos provided by Dr. Kameshwary Chebroulu are given to experimental group students (<http://www.it.iitb.ac.in/moodle/course/view.php?id=114>).

If the student has any doubt he/she can raise doubts in the lecture hour which is conducted after experimental group watched the videos. In the classroom, the discussion was held with experimental group and the students in the group can get clarified their doubts in the class. This class is no longer the traditional teaching class moreover it is the discussion that happened in the class regarding the topics watched by this group in the videos.

C. Post Test:

The level of understanding is analyzed of two groups by taking post test. Both the groups control group and experimental group made to attempt same questions on the selected topics for experimentation.

Some sample questions asked in post test are given below,

1. What are different error detection protocols? (Recall Level)
2. Compare between Go back N and Selective Retransmission Protocols. (Understand Level)
3. for the transmitted bit pattern 11001000 detect the errors and correct it by using Hamming Code. (Apply Level)

The observations are that,

- i) The questions at recall level are attempted well by both groups.
- ii) But experimental group performed well than control group for the questions which are at understand and apply level.

Hence experimental group students scored more marks in post test compared to control group students.

D. Feedback

At the end of the activity the feedback is conducted from experimental group. This feedback will indicate the students' understanding of the concepts and willingness for the active learning strategy.

Table 1: Feedback

Sr No.	Questions	Poor	Fair	Good	Excellent
1	To what extent you understand technical Contents from video lectures?	3%	7%	41%	49%
2	Does this Teaching method made you more attentive?	0%	14%	45%	41%
3	Whether flipped classroom helped you to increase your understanding level?	0%	1%	42%	47%
4	Have you enjoyed the teaching method?	0%	7%	36%	57%
5	Would you recommend similar sessions for the other topics also?	6%	16%	37%	41%

5. Result Analysis:

The post test is conducted for both groups control and experimental group. The marks obtained are plotted for in Fig. 4. From the plot shown in Fig. 4 it is clear that higher marks are achieved by experimental group compared to control group.

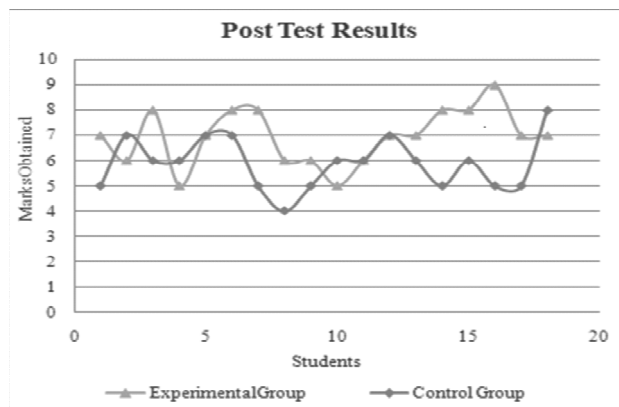


Fig. 3: Post Test Results

t-Test is used to determine if two sets of data are significantly different from each other. The p-value measures consistency between the results actually obtained in the trial and the "pure chance" explanation for the results. P-value provides an evidence for the significant results obtained by comparison of two groups (Ronald A.Thisted ,2010 & Luc Demortier ,2007).

Table 2: Statistical Analysis using t-Test Result

t -value	Standard Deviation	Degrees of Freedom	P - value
2.97	1.07	34	0.0054

*The result is significant at $p < 0.05$

6. Conclusion:

This paper presented an experience report regarding the use of Flipped classroom for subject Computer Network for final year engineering students. The p-value and t-test results that shown in Table 2 indicate that, the marks obtained in the post test by experimental group (i.e, students underwent Flipped classroom) are considerably higher than the marks obtained by control group (i.e, students underwent traditional teaching). This means that the experimental group students reached the higher level of bloom's taxonomy i.e., apply level compared to control group students. Whereas, few of control group students reached to understand level and other are at recall level only. From the feedback obtained by experimental group students, it is found that students' are engaged in the activity and enjoyed the Flipped classroom activity. Hence, Flipped classroom can be the better choice than traditional teaching for students' active participation in learning and hence in turn improving students' learning.

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