



Use Of Flipped Classroom Concept For Practical Experimentation Course In Electronics And Computer Hardware

Dr. Varsha M. Bapat¹ and Dr. Neha Deshpande²

1. Associate Professor, PES's Modern College of Arts, Science & Commerce, Pune.

2. Associate Professor, MES's Abasaheb Garware College, Pune-4

ABSTRACT

Practical experimentation is an essential component of teaching process. When the course contents have to be delivered to the students in a classroom, the theoretical background of the topic has to be made clear, which time and again is provided through series of Theory sessions or lectures. To support these theory sessions and enhance the comprehensive understanding of the topic, practical experiments are designed by the Expert teachers. Students get limited time span to perform the experiment and understand as well as analyze the results. The instructors explain and demonstrate the experimental setup during the same time span which leaves very less time for actual experimentation and repetition of the experiment. As a result of this, most of the students do not understand the concept and application of the experimentation. In this research work a methodology of Flipped classroom is proposed where the Educator will make a video clip of every experiment as per the syllabus for a class. In this video session, the theoretical background will be explained at the beginning and then the demonstration related to making connections, noting down the observations, debugging the errors and concluding the experiment will be covered. These videos will be shared with the students through internet well ahead of the experimentation schedule so that students can go through them until they understand as per their grasping level and spend more practice time in performing experiments in the Laboratory.

Keyword: Flipped Classroom, Practical experimentation, video sessions, Comprehensive Understanding, More practice time.

1. Introduction

The role of ICT in education has become essential and unavoidable. There are new methods introduced globally which need ICT support. Teaching and Learning process becomes easier effective and innovative with this support. It is reported by the researchers that, the growing use of ICT as an instructional medium is changing and will likely continue to change many of the strategies employed by both teachers and students in the learning process[1]. Technology has the capacity to change the traditional teacher oriented approach to a student centric pattern. Earlier there were very few choices provided by the institutes and had little flexibility for selection of the courses. But, now it is the demand of the time that students get variety, flexibility as per their convenience. The teaching methods need a drastic change to support the needs from student community and impart quality and skill based education. In most of the traditional teaching methods more stress is given on theoretical lecture delivery and students are reluctant to attend these sessions. If activity based learning is made available for them , they would take more interest and put in more efforts to learn new things.

Flipped class learning is a pedagogical methodology in which the conventional way of classroom-based learning is inverted, so that students are introduced to the learning material well in advance the class, with classroom time then being used to enhance the understanding through discussions with students and more problem-solving sessions are provided by teachers[w1]. In the flipped classroom method, students obtain knowledge at home before the class and the classroom time is utilized to practice and clear the concepts and ideas through interaction with Teachers and other classmates. Thus, learning *process* becomes easier and students with different level of understanding can learn at different pace and can get knowledge[W2]. Jacqueline O'Flaherty reports about increasing pressure on Higher Education institutions to undergo transformation, with education being seen as needing to adapt new techniques which can meet the conceptual needs of our time. Improved academic performance and student and staff satisfaction may be seen with the flipped approach [2]. Butt reports in his study on move to a flipped classroom approach in a compulsory final-year course in the undergraduate actuarial program at the Australian National University (ANU). He explains how this approach has shown a positive raise on results [3]. Prince (2004) in his study has reported the importance of active learning environment in both discipline specific environments and overall higher education systems [4]. Baeten, M., (2010) has reported the factors encouraging the student centric learning environments and how the concept of Flipped classroom can lead to effective teaching and learning process[5]. Bergmann, J., & Sams, A. (2012) have actually carried out flipped class for their laboratory based experiments and found that they had more time for Laboratory experimentation as well as problem solving sessions. They clearly mentioned that the flipped class model was really efficient than traditional lecturing and assigning homework[6].

2. Background

Practical course is an essential part of Undergraduate as well as Post Graduate courses in Science stream. Students can learn many things through the practical experimentation. The theoretical study can be supported with the practical experiments to clear the concepts in respective subject.

During the practical session it is observed that most of the students come for the practical without studying the basic theory and working principal of that experimental setup. This leads to lack of subject knowledge as well as poor understanding. Many a times students perform the experiments mechanically without understanding the actual concept and purpose of the experimentation. Teachers and Instructors or Laboratory Technicians, waste more time in explaining the theoretical background of the respective subject of the experiment. Also, with large batch size for the practical session, it becomes difficult to cater the requirements of every student in the laboratory. Students observe the demonstration given by the Teacher and avoid doing the experimentation due to lack of confidence of performing it individually on their own.

The practical experiments are designed to familiarize with current and recent technological developments and enrich their knowledge through practical course. Students can learn many skills related to electronics industry and market through the practical experimentation. Students get interest in particular field and a foundation for research and development can be built in Electronics through creative experimentation. Students analytical abilities can be enhanced towards real world problems in respective subject.

It is the need of the subject that students get to know the basic concept cleared through the practical experimentation. While working on Electronics circuit boards or experimental kits, students need to remember the process of connecting the circuit elements for certain application and then take a set observations to understand the characteristics, working operation and then the application of a particular component or circuit. Just performing the experiment once is not sufficient to clear concepts and thorough understanding of the circuit. This leads to fear of the experimentation in students mind and also leads to lowering their confidence level while facing the examination.

But with the introduction of the Flipped classroom concept these problems may be overcome since the videos of actual theory sessions, circuit board connections and demonstrations will be available to the students well in advance. Also, this material they can access from anywhere since it will be made available online. They can go through the experimental procedure and theoretical background for as many times as they wish till the concept is clear and they understand the process to a level that they can perform well during the actual experimentation in the laboratory. Frequently Asked Questions may be resolved with the study material provided to the students. After completing this process of pre-experimentation procedure at home, students can perform the experiments in the laboratory in supervision of Teachers or Demonstrators. Also, Teacher will save more time on explaining the theoretical background and will be able to convey more advance

knowledge once the base is clear. Students can perform the experiment for longer time with variety of combinations as per their satisfaction level. This will surely boost their confidence level and will allow them to think more on their direct applications in the industry. Teachers can utilize the saved time to explain the role of the respective experimentation in actual industry. Flipped classroom concept has been beneficial to the student community in recent years and on global level it is appreciated by the researchers.

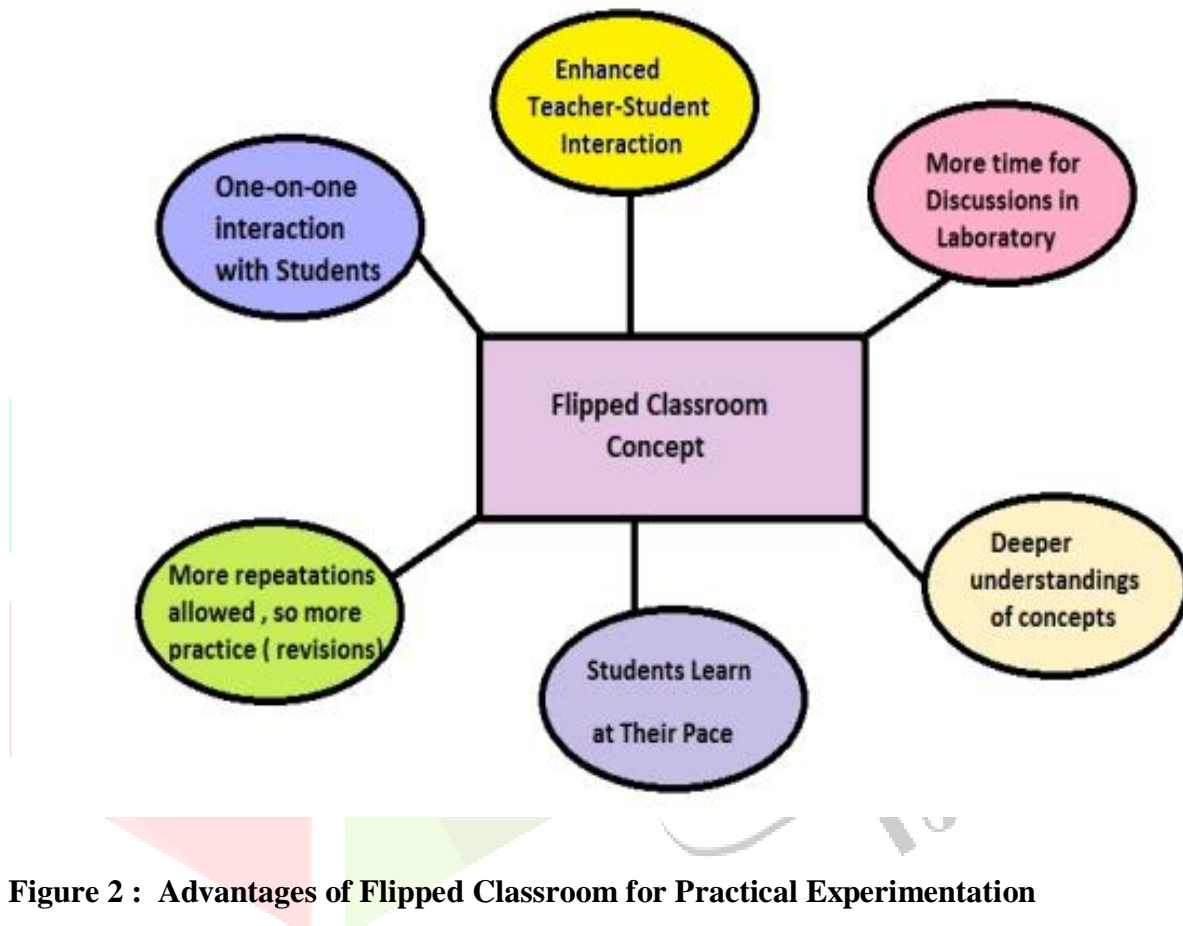


Figure 2 : Advantages of Flipped Classroom for Practical Experimentation

Figure 1 shows the advantages of using Flipped classroom concept in the Laboratory. The interaction between the student and the teacher can definitely improve and can be on one to one basis which will increase the understanding level of the student. More time will be available for the students and teachers for experiment related discussions. Students can explore variety of methods for the implementation and thus research attitude can be inculcated among the students. The understanding level will be increased to a large extend with this method since students can get a chance to perform the experiment for several times. Students with different grasping level can learn at their pace with more repetitions of the experiments. Thus, with the Flipped classroom concept students as well as teachers can improve the teaching and learning quality and can provide knowledgeable product output from educational institutes.

3. Experimental Study

The Flipped classroom was carried out with six different practical experiments for first year students in the college. These experiments were based on basic Analog electronics containing study of characteristics of Semiconductor devices like Rectifier Diode, Zener Diode, Solar Cell, Bipolar Junction transistor (BJT), BJT as a switch and as an amplifier. The experimentation write-up sheets were provided to the students well in advance as a softcopy. Videos for every experiments were taken during the theoretical explanation and demonstration. These videos were shared with two Practical Batch containing 35 students. For other two batches practical experiments were carried out in traditional way.



Figure 3.1 : Students enjoying performing the experiments in the laboratory with Flipped class implementation.

After the completion of the six practical sessions for all the four batches, a survey was carried out to obtain their views on sessions in traditional ways and the flipped classroom method. Students' views were far more positive to the new teaching style of Flipped class room. The understanding level and the confidence to perform the experimental work was increased to a large extent with the students gone through flipped classroom style rather than those who were part of traditional teaching methods Figure 3.1. Students were taking more interest in performing the experiments individually without any hesitation. They could get more time to spend on the experimental boards and perform the experiment for several times with variations in the observations and were reaching their satisfaction level. Also, more time was spend on clearing their doubts about the experiment through longer interactions.

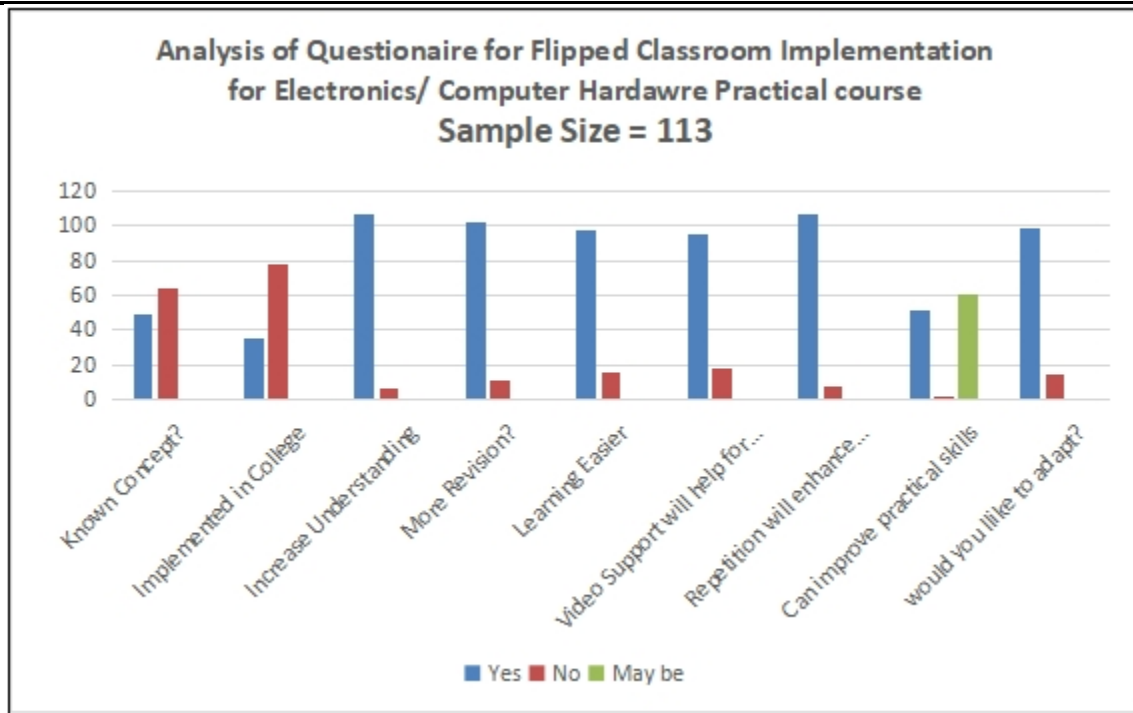


Figure 3.2 : Analysis of the survey made after implementation of Flipped Classroom concept

Through the survey carried out during the study as shown in the Figure 3.2, students were asked questions regarding their understanding level for a particular experiment, benefits of revision turns in a stipulated time period, their comfort level with the material and videos provided to them well in advance and their acceptance to this new method of Flipped class room. A sample size of 113 students from four Practical batches of UG and PG courses were considered for this study. After the completion of all six sessions of the practical coursework this survey was carried out for 6 batches, four with implementation of Flipped classes and other two with traditional approach. From the survey it is very clear that students practical skills for Electronics subjects can be drastically improved with this approach. Students get familiar with the instruments due to extra time spent on practice and revision. The confidence level of the students while performing the experiments is noted to be improved.

From this survey it is very clear that students have given a positive response to this new methodology. The understanding of the concept level is raised to a good extent. Student appreciates the availability of more time for more number of repetitions. More time they can spend on revision and thus understand the working properly. Since the study material in the form of text and videos is available for them in advance their comfort level is raised and confidence level has elevated to a large extent.

4. Conclusions

From the survey carried out with the implementation of the flipped classroom for Practical experimentation in Electronics and computer hardware, it can be observed that students are satisfied with the study material and videos related to experimental procedures provided to them in advance before the actual performance on the experimental boards. They get enough chance to perform the experiment repeatedly till they understand the concept and application of the same. More time is spent on experiment performance rather than in theoretical explanation which leads to raise in their confidence level. Also, the interaction between student and teacher is increased and teacher can spare more time for one to one interaction. Students can give more time to think about the experiment and can resolve the queries at the time of practical session. Students feel very comfortable with the experiment boards and their connections and so their fear about the experimentation is phenomenally reduced. Thus, Flipped Classroom technique can be effective for the Practical course in Electronics and Computer hardware.

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