

# Cummins College Digest of Engineering Education

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**MAHARSHI KARVE STREE SHIKASHNA SAMSTHA's**  
**Cummins College of Engineering for Women**

(An Autonomous Institute Affiliated to Savitribai Phule Pune University)

Karvenagar, Pune.

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## Digest Overview

- ❖ The *Cummins College Digest of Engineering Education (CCDEE)* serves to cultivate, disseminate, and archive scholarly research in engineering education.

### The Purposes of *CCDEE*

- ❖ To provide a platform for publishing original research in engineering education.
- ❖ To provide a forum for sharing innovative practices for imparting engineering education.
- ❖ To provide a forum for sharing innovative strategies issues which are unique to engineering education in India and abroad.
- ❖ To foster international collaboration and discourse for the betterment of different aspects of engineering education.

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- ❖ Only manuscripts that have a focus on engineering education will be considered for publication.

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- ❖ Research articles in engineering education theory and practice.
- ❖ Articles on best practices to enhance the quality of engineering education, supported by assessment.
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## Integrating Honesty factor in online examination in post corona era

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### ABSTRACT

March 2020 will forever be known in the education community as the month when almost all the world's schools and colleges shut their doors. The coronavirus pandemic has changed how millions students are educated around the world. Those changes give us a glimpse at how education could change for the better - and the worse - in the long term and assuring honesty in online examination has become an important challenge. The short communication in this paper is focused on how to integrate honesty factor in online examination in post corona era.

### INTRODUCTION

Post corona poised enormous challenges in teaching-learning process. Sudden change in teaching-learning mode left no time for teachers to test and then adopt online systems. This demanded quick exploration and immediate implementation of online education system from physical education. The major challenge is to motivate passive learners, who were seldom leading for studies, even during previous physical education [1 – 5].

However, National Board of Accreditation, paved path in 2015 itself for Outcome Based Education (OBE). It taught teachers to always explore newer methods (PO5) by continuous self-learning (PO12) with effective communication (PO10) in lesser cost (PO11) and structured way (PO8), to help students sustain knowledge (PO7), for imbuing engineering culture (PO6), to enable students competencies in individual and group working (PO9), to design and develop solutions (PO3) in any complex engineering situations (PO4), by imparting problem analysis skills (PO2) and Engineering knowledge (PO1) in them.

Figure 1 shows possible solutions for problem posed by passive learners.

During online assessment, it is common that, passive students found copying answers during examination defeating purpose of test conduction and planning by teachers.

This problem can be resolved in two sequential ways.

1] No questions should be copied or answers available for simply copying in examination.

2] Integrate honesty factor, self-assessed by students during assessment as depicted in case study.

A unit test was conducted for 30 marks (15 questions) in online mode with MCQs of one or more options correct. All questions were in Higher Order Thinking Skills with one or more than one options correct and were plagiarism tested for ensuring zero percent similarity.

After test was over and assessment was completed, students were asked to fill MS teams form (Similar to Google Form) to collect data, as to how many questions they solved on their own and how many questions they asked help from other students or internet resources, which was not a good practice for learning. If all 15 questions were solved by students on their own, students were awarded 20 additional marks, making unit test out of 50 marks (30 marks for Technical Assessment and 20 marks for Honesty award).

Following were the observations drawn:

- Only 17% students claimed 20/20 marks for self-honesty and 83% of students claimed less than that.
- These 83% of students given feedback that, this was the best exercise, they assessed themselves to self-realize their competencies and promised to be 100% honest in next examination to claim all 20 marks.
- 58% of students felt that, after they confessed, their burden was removed and they felt fresh.
- One student self-claimed zero for himself and that was the best moment of this exercise.
- 99.2% of students felt that, updated marks out of 50, are the true indicators and can be effectively utilize in our education system.
- One of the student's best reply was, "It took me for a while to realize and reply you...But First time I felt about power of honesty, which I never before thought of really".

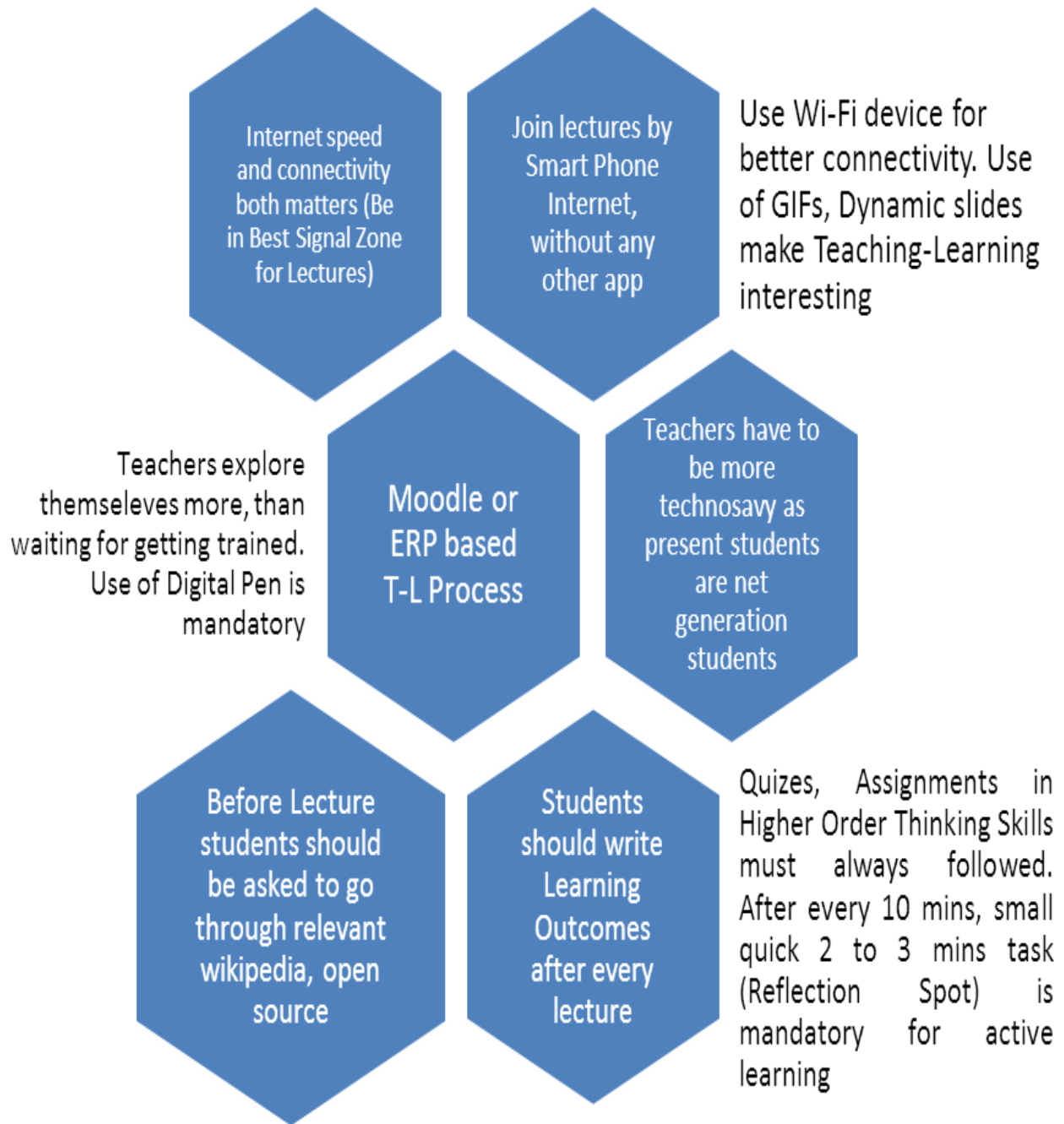


Figure 1: Possible Solutions for Problem Posed by Passive Learners



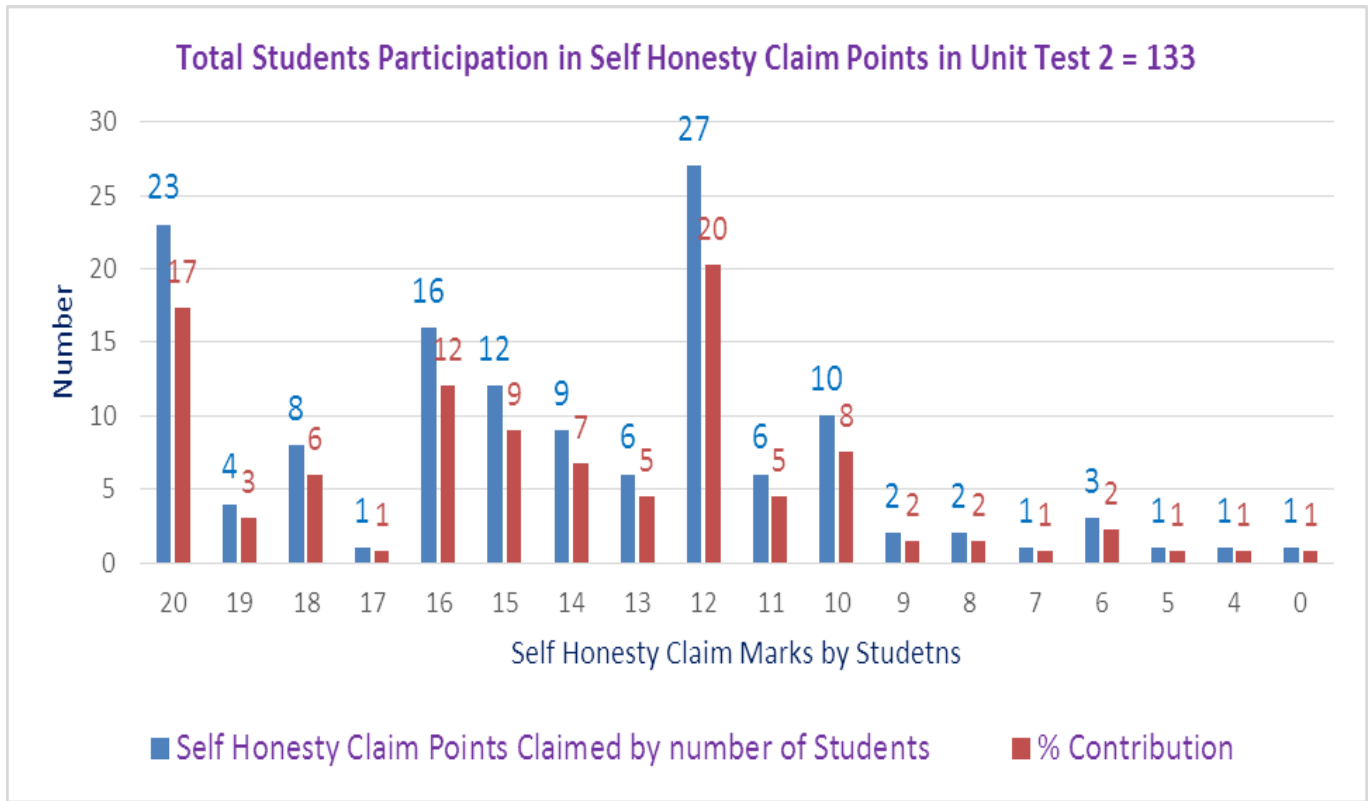


Figure 2: Self Honesty Claim Points

From this exercise, it was evident that, students felt burden and guilty of not attempting all questions on their own and realized that they will have to do deep learning to avoid this guilt. Students will do self-testing very honestly and ready to accept their mistakes, provided it is accepted by teachers and scope for improvement is provided to them. Most importantly, students realized that, examinations are conducted to ensure studies and learning instead of just evaluation and certification.

Different teaching learning process plays an important role. Over the years several techniques and tools have evolved to improve the students learning and engagement. Advancement in the technology has contributed greatly to this. Flipped classroom, Think pair Share(TPS), peer instruction, project based learning, problem based learning, case study based learning, demo based learning, Activity based learning (role play, crossword, quiz etc), inquiry based learning are most commonly used as best teaching practices were experimented for its effectiveness to enhance the teaching learning process. But, integrate honesty factor in online examination was not addressed by earlier researcher [6].

**Conclusions**

In this short communication, an attempt has been made to address an important issue of assuring honesty in online evaluation / examination process. This paper discusses a small exercise related to self-honesty claiming and it can be concluded that, students realized that, examinations are conducted to ensure studies and learning instead of just evaluation and certification. Few other aspects of integrating honesty factor in online examination can be explored further.

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## USE OF THINK-PAIR-SHARE (TPS) AS AN ACTIVE LEARNING STRATEGY TO TEACH METROLOGY COURSE

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### ABSTRACT

Research in engineering education studies related to use of active learning methods are more focused on instruction in lab sessions, while for large lecture classes have mainly concentrated on peer discussion. Think-Pair-Share (TPS) is a classroom-based active learning strategy. This paper explains the effect of use of TPS an active learning method during teaching to a large class for Metrology course of Mechanical Engineering under graduate programme. Response to survey questionnaire showed improvement in the post-survey compared to the pre-survey, suggest that, students believe using the Think-Pair-Share Technique contributes to more student participation during discussion in Metrology class and increase their confidence.

### INTRODUCTION

Inductive teaching and learning is an umbrella term that encompasses a range of instructional and learning methods such as, inquiry learning, problem-based learning, project-based learning, case based teaching, discovery learning, Peer instruction (Lee et al., 2011; Simon et al. 2013) and just-in-time teaching (Bonwell, 1996). Such instructional strategies are based on active learning, that is, students are engaged in specific activities, often collaborative/ cooperative, in which they “express their thinking via writing, speaking or other actions that go beyond listening and the copying of notes” (Meltzer and Thornton, 2012). Panitz and Theodore (1999) argued that, such cooperative learning helps consensus building through cooperation by group members, in contrast to competition in which individuals best other group members.

In general, engineering education research(EER), studies based on active learning methods have had a history for instruction in lab sessions, such as small group completing the task of lab work/experimentation (Nosek, 1998; Radermacher, 2012, Duan and Ries, 2007), while research on active learning techniques for large lecture classes has mainly concentrated on peer discussion (Kothiyal et al. 2013). There is a need of research-based evidence from engineering courses of different active learning techniques addressing a variety of instructional goals (Meltzer and Thornton, 2012). This paper explains the effect of use of Think-Pair-Share –as an active learning method during teaching to a large class of Metrology course of Mechanical Engineering Program (MEP).

### RELATED WORK

Metrology is an important topic in under graduate programme of Mechanical, Production and Automobile engineering. The Metrology course at the S. P. Pune University covers many topics such as the concepts, tools and techniques of Linear / Angular Metrology, Dedicated Metrology, Instrument Selection, Calibration Process, Gauge design and Gauge R&R. The students taking this course are in third year of Mechanical Engineering Programme (MEP).

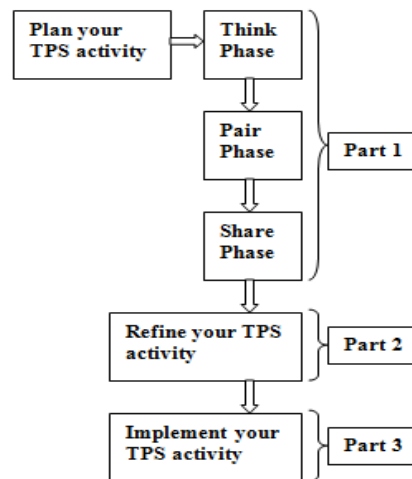
Conclusions of published studies recommend the use of non-traditional technique to addressing the instructional goals of a Metrology course, such as classroom activities should have characteristics that allow students to analyse real life a problem, write open ended responses, work in groups and discuss solutions etc. Furthermore, in addition to conceptual understanding, it also demands that, students should be able to understand concepts right from, basics of analyzing measurement need; selecting appropriate instrument and references; calibration etc. to offers related solution(s) can trigger higher order thinking process. Hence to engage learners in such higher-order thinking, and as a feedback mechanism both for students and teachers (Radermacher, 2012), Cooper and Robinson (2000) recommend TPS as a teaching technique. However, TPS has not been widely researched and evaluated for objective evidence of student response or learning for Metrology course. However, TPS has not been widely evaluated and researched for objective evidence of student engagement or learning (Kothiyal et al., 2013). In this paper, we report the results of the use of Think-Pair-Share –as an active learning method and attempted to analyse students' participation in the discussions related to problem analysis and sharing the solution during the large class for Metrology course setting. Hence, the objectives of the present study are: (i) to understand whether the use of TPS activity in Metrology class helps the students to improve the conceptual understanding about the course, (ii) to analyse student's participation in class discussion as well as students' confidence in their abilities to analyse and share the solution by applying measurement and calibration process related concepts/tools.

### METHODOLOGY

In addition to the benefits reported by earlier researches viz. (Kothiyal et al., 2013; Cooper and Robinson, 2000; Bonwell and Eison, 1991) we chose TPS for the following reasons: Metrology being an important course, two key learning outcomes are that students should be able to analyse measurement need, select correct instrument, analyse repeatability and reproducibility and

calibrate the instrument under consideration to acquire conceptual knowledge as a part of dimensional metrology. For most of such tasks, multiple valid solutions for reference selection may be possible. So it is desirable that students also be able to analyse the pros and cons of various solutions. After understanding, there is a need to use a format of active learning, which could encourage a student to come up with his/her idea about the solution first, allows students to work with each other for detailing so that they do not feel daunted by the task, and discuss pros and cons of multiple solutions. I found that, Lyman in (1981) introduced Think-Pair-Share technique, has been widely discussed, used and recommended in the literature (Lyman, 1987). TPS an active learning strategy can be modified to fit any class size and any situation (Lane, 2008). It offers benefits of small-group collaborative learning in a large lecture class, makes students to think about course content under consideration and allows students to formulate their reasoning individually before sharing with others, which help them to develop higher order thinking skills (Meltzer and Thornton, 2012). Furthermore, TPS provides students prompt and descriptive feedback on their understanding, both from their peers and from the instructors, which they can use to modify their learning and teaching respectively. TPS could be a natural good fit for meeting these requirements during teaching to a large class for Metrology course of MEP.

Procedural steps for implementing TPS technique: TPS technique consists of three phases as shown in Figure 1, which is structured as: At start, instructor plan for TPS activity. [Activities during TPS procedural steps are in line with guidelines given during AICTE approved FDP on 'Use of ICT in Education for online & Blended Learning' conducted by, IIT Bombay].



**FIG 1: Procedural steps commonly used for implementing TPS technique**

### Part 1 – Plan your TPS activity

During Think – phase, the instructor poses a question to which students individually write their answers, while during Pair – phase, students work on a well-defined task with their neighbor(s), and during Share – phase, students engage in a class-wide discussion, sharing their answers and reasoning, and debating alternate solutions (Kothiyal et al., 2013). During this TPS activity, students do not have to move from their current seats and discussion can be guided. This technique enables students to work on a problem posed by the instructor, first individually, then in pairs or groups and finally together with the entire class. Group formation in Think-Pair-Share is done informally; students typically turn to their neighbours and begin discussing the task at hand. In turn, they get encouraged to come up with his/her idea of the solution first. Instructors favor TPS because it is perceived to be relatively easy to implement and allows students to work with each other for detailing so that they do not feel daunted by the task, and discuss pros and cons of multiple solutions. Depending on the nature of the task in the Think-Pair-Share activity, it can be used in different stages of the instructional sequence .and used by teachers at both the college and school levels (Bonwell, 1996; Johnson and Johnson, 1999).

Faculty can continue further discussion into the topic. If faculty feels that, many of the points that he/she wanted to convey are already covered, then the TPS activity can be considered as successful activity!

### Part 2 (Optional): Refine your TPS activity

Note: Do in line with guideline(s) either/both of the below:

1. Talk to a colleague who is familiar with your topic or the TPS technique. Get feedback on whether:
  - i.the statements that you wrote in Part 1 capture what you want students to do in each phase,
  - ii.there is a logical connection between your phases,
  - iii. the timings for each phase are ok.
2. Predict the responses that you will get from students in the share phase. Use the space below to write down some predictions and later compare them with what actually happens in your class.

### Part 3: Implement your TPS activity

Some guidelines for what to do in class when you implement your TPS activity:

1. Don't panic if no activity happens in the first minute. Students will take time to get started.
2. Do encourage students to write their ideas down, especially during the think phase.

3. Do walk around the class during the pair phase, answer relevant queries, encourage students to talk to their neighbor, and to write down their answers. Keep track of time also.
4. Do discuss a few representative students' solutions in the share phase, and then transition into points that you want to highlight. It is ok if this phase takes 20% more time than you anticipated.

**IMPLEMENTATION**

**Course Format**

The setting for our study was a large enrolment Metrology class. The instructional goal was to teach Metrology concepts and skills to a population of 72 third year undergraduate students of MEP. The topics addressed were: Concepts of analyzing the measurement need, selecting correct instrument, analyse repeatability and reproducibility and calibrate the instrument. The course was conducted during 1st over 13 weeks in started in 2<sup>nd</sup> Semester of A.Y. 2018-19, and was organized into lectures, labs, and exams.

**TPS Intervention in Lectures**

One of the challenge for effective teaching-learning process in case of large class session as discussed earlier is that, some students may tune out, while others may engage in distractions (like talking to each other on off-task topics etc.). 1st example of TPS activities in this section (is from Metrology and 2<sup>nd</sup> example is from Quality Control Course), which corresponding to the key learning outcomes mentioned above.

**Example 1:** Prerequisite: Explanations related to applications of Measurement and Calibration Process and difference between them

<b>1.Think phase:</b>	Time (5 min)
Write your Think Phase Question here: Think over to identify and list out different applications of Measurement and Calibration Process.	
What will Instructor do: Poses the question, asks students to think individually and write in their notebook	
What will students do: They will think to identify and list out different applications of Measurement and Calibration Process, writes answer in the book	
Deliverable from this Phase: <u>Recall/remember</u> the reference(s)/notes given for 'out class-assignment'	
<b>2.Pair phase:</b>	Time (5 min)
Write your Pair phase question here: Try to find as many different applications of Measurement and Calibration Process. Now discuss your list of applications with neighbour and compare with their list.	
What will Instructor do: Asks students to pair up and discuss, goes around the class to check whether students are discussing, provides clues to pairs who are in doubt and observe to the feedback/response form students.	
What will students do: Pairs up with neighbor, Checks each other's application list.	
Deliverable from this Phase: With the help of exact applications students will <u>understand</u> the difference between Measurement and Calibration process.	
<b>3.Share phase:</b>	Time (10 min)
Write your share phase task here: Share list with the class to identify	
What will Instructor do: Shares their answers to the class	
What will students do: Write and share	
Deliverable from this Phase: After <u>understanding</u> exact need of an application under study, student can <u>compare/analyze and identify</u> the difference between Measurement and Calibration process.	

**Example 2:** Prerequisite: Explanations related to types and selections of quality tools to analyze failure modes for its causes and its criticality to prioritize them {example from 'Quality Control' Course}.

<b>Think Phase:</b> In case of identified failure modes for selected product/process during earlier classes; think over to causes of failure modes and do FMEA and prioritize them.	Time (5 min.)
What will Instructor do: Poses the question, asks students to think individually and write in their notebook	
What will students do: They will think to identify and list out different causes of failure modes and do FMEA and prioritize them, writes answer in the book.	
Deliverable from this Phase: Recall/remember the reference(s)/notes given.	

<b>Pair phase:</b> Try to find as many different causes of failure modes and do FMEA for identified failure modes for selected product/process. Discuss your list of with neighbor and compare lists.	Time (5 min.)
What will Instructor do: Asks students to pair up and discuss, goes around the class to check whether students are discussing, provides clues to pairs who are in doubt and observe to the feedback/response form students.	
What will students do: Pairs up with neighbor, Checks each other's list.	
Deliverable from this Phase: With the help of identification of relationships between failure modes and their possible causes for its further FMEA will help student to understand the process.	
<b>Share phase:</b> Share list with the class to identify	Time (10 min.)
What will Instructor do: Shares their answers to the class	
What will students do: Write and share	
Deliverable from this Phase: After understanding exact need of an application under study, relationships between failure modes and their possible causes for its further FMEA will help student to understand the process for selected different products/processes.	

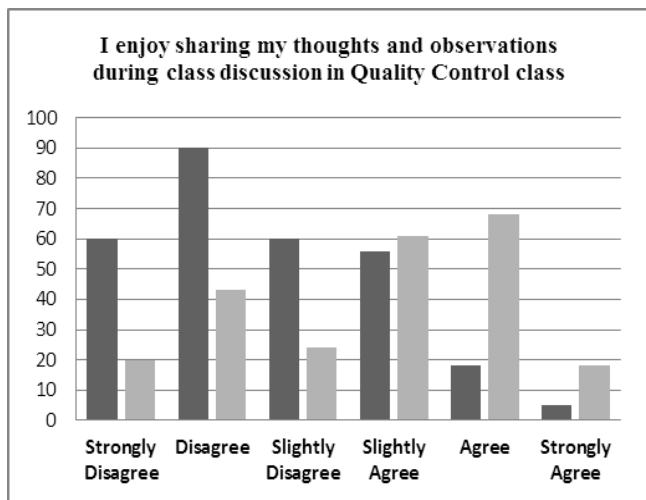
**INSTRUMENT: SURVEY QUESTIONNAIRE**

With the objectives to keep students engaged with the content, the instructor and each other, as well as to triangulate our findings related to analysis of effect of TPS activity on students, Survey Questionnaire (refer Annexure-I) as an instrument was used in this study to measure self-reported student engagement during the TPS activities. While preparing the Questionnaire; questions in the questionnaire survey as instruments for data collection by earlier researchers viz. Ariana (2013) and Dol (2014) were referred.

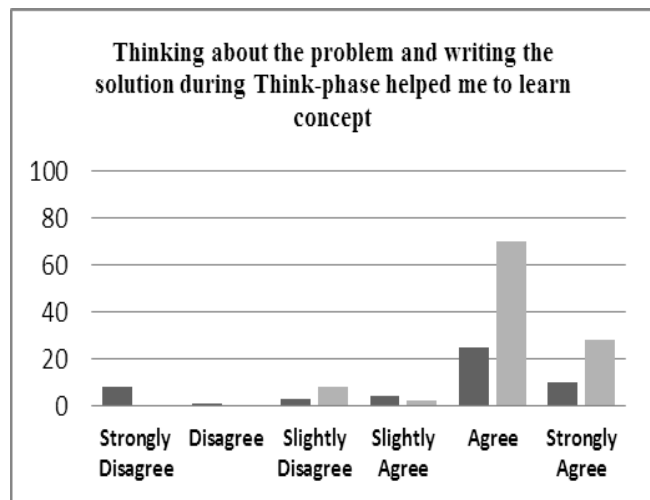
The goal was to answer the research questions as to measure how often they believe they participate in class, how they feel about participating in class discussion, and their confidence in their abilities to analyse individually, thinking about the problem and writing the solution during the think phase whether helped them to learn concepts, discussing their solution with their peers/group members/partner during the pair phase whether helped them to learn concepts and a final question, which asked their opinion on whether the TPS activities caused them to stay interested in the content of the lecture so did they like the Think-Pair-Share activity? All the questions were to be answered on a five point Likert scale. In case if course instructor / co-instructor wanted to evaluate the students' involvement or effectiveness of T-P-S method adopted, 'Rubrics' is provided as a solution attached as Annexure-II.

**RESULTS ANALYSIS AND DISCUSSION**

The students took a survey about their class participation and confidence at the beginning and at the end of the study. Below, are charts from figure 1 to 9 comparing the answers students selected in the pre-survey (black) and post-survey (gray).



**Fig. 2 Response to question1**



**Fig. 3 Response to question2**

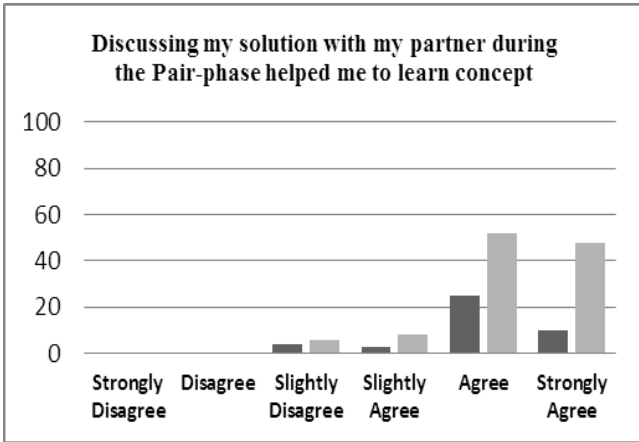


Fig. 4 Response to question 3

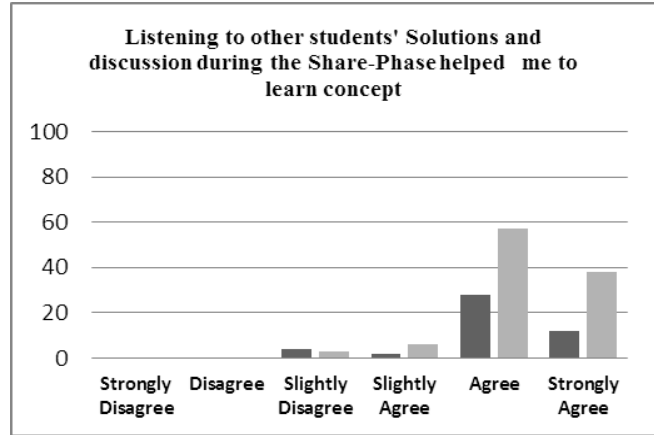


Fig. 5 Response to question 4

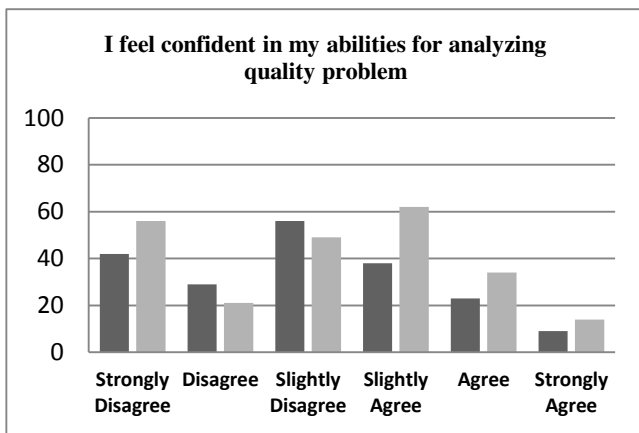


Fig. 6 Response to question 5

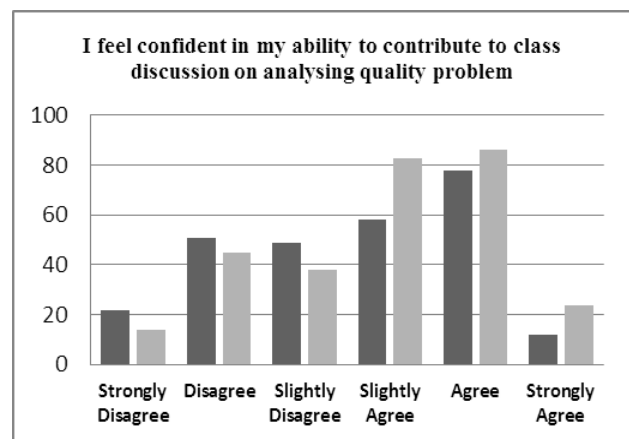


Fig. 7 Response to question 6

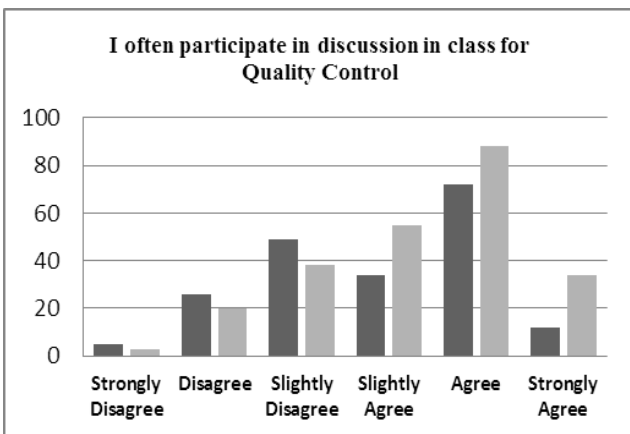


Fig. 8 Response to question 7

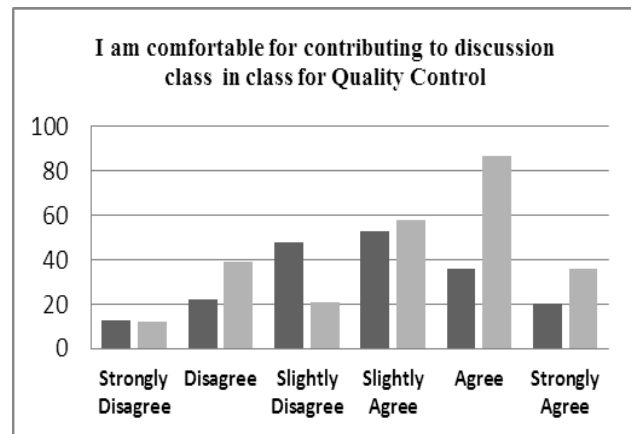


Fig. 9 Response to question 8

The response to the question at the end of questionnaire; Did you like the Think-Pair-Share? got 100% positive reply.

## RESULTS AND DISCUSSION

Response to, through survey questionnaire, such as, 99% students agreed that think-pair-share activity developed interest in them to learn. 100% students agreed that thinking about the problem and writing the solution during the think phase helped them learn concepts more precisely and about 98% students agreed that discussing the solution with the partner during the pair phase

helped students learn concepts more clearly. Further, 96% students agreed that listening to other students' solutions and discussion during the share phase helped to learn concepts. Also 100% students agreed that they found the Think-Pair-Share activity effective.

## CONCLUSIONS

In this paper, how TPS activity can be used for Course of Quality Control MEP is explained. The results of the pre-survey and post-survey suggest that think-pair-share had a positive impact on students' views about participating in discussion in Metrology class. Response to questions showed an improvement in the post-survey compared to the pre-survey. The surveys' results also suggest that, students believe using the think-pair-share technique contributes to more student participation.

Response to, through survey questionnaire, such as, 99% students agreed that think-pair-share activity developed interest in them to learn. 100% students agreed that thinking about the problem and writing the solution during the think phase helped them learn concepts more precisely and about 98% students agreed that discussing the solution with the partner during the pair phase helped students learn concepts more clearly. Further, 96% students agreed that listening to other students' solutions and discussion during the share phase helped to learn concepts. Also 100% students agreed that they found the Think-Pair-Share activity effective.

This paper advocate the benefits reported by Ariana (2013), as provides opportunities for students to learn from each other, practice using and developing their quality control related vocabulary and practice using reasoning skills were experienced for Metrology course also. Result analysis also corroborating with conclusions about use of this technique also seemed to help a few students increase their confidence in their ability to analyse quality related problem and also to contribute in class discussion, which reinforce decision to use think-pair-share as one of the effective instruction technique for teaching courses like Metrology and Quality Control.

## ACKNOWLEDGMENT

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- Major part of this paper and references are reproduced [for different example of the same Quality Control Course] with the permissions form organizer's of *National Symposium on Innovations in Teaching-Learning Process, December 08, 2018 (Saturday) D. Y. P.C.O.E. Ak.,Pune In association with ISTE.*

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Annexure – I

Sr. No.	Questions	Disagree	Slightly Disagree	Slightly Agree	Agree	Strongly Agree
1	I enjoy sharing my thoughts and observations during class discussion in my math class					
2	I feel confident in my abilities for analyzing quality problem					
	I feel confident in my ability to contribute to class discussion in math class					
3	I often participate in class discussion in math class					
4	I am comfortable contributing to class discussion in my math class					

Annexure – II

Criteria	Levels		
<b>Aptness of Think-Phase</b>	<input type="radio"/> The Think Phase activity is very broad, hence all students will not be able to attempt this activity. or The submission does not have a valid Think Phase activity.	<input type="radio"/> Most of the students will be able to write a response to this T-Phase activity, however there will be some who will not be able to attempt this.	<input checked="" type="radio"/> The Think Phase activity is broad enough that all students in class are able to write a response.
<b>Duration of Think Phase</b>	<input type="radio"/> The time required for Think Phase is either not mentioned or is too large that students will get bored.	<input type="radio"/> The time required for Think Phase is slightly high (greater than 3 minutes) and this may cause completed students to be restless and bored.	<input checked="" type="radio"/> The Think-Phase activity is designed to be completed in 1-3 minutes so that all students are able to complete the activity.
<b>Aptness of Pair Phase</b>	<input type="radio"/> There are no Pair Phase activities submitted.	<input type="radio"/> The Pair Phase activity can be done by an individual and does not require a pair	<input checked="" type="radio"/> The Pair Phase activity requires a pair to perform this activity and cannot be done by an individual alone.
<b>Duration of Pair Phase</b>	<input type="radio"/> The time for Pair Phase activity is either not specified or insufficient to complete discussions.	<input type="radio"/> The time specified for Pair Phase activity is slightly high (greater than 8 minutes) which will make students go off-topic after their discussion is over.	<input checked="" type="radio"/> The time specified for P-Phase is between 5-8 minutes which allows sufficient discussion to happen without students going off-topic.
<b>Connection between Phases</b>	<input type="radio"/> The activities between the Think-Pair-Share phases are not connected at all.	<input type="radio"/> Some aspects of the TPS are connected or at least activities for 2 phases are connected.	<input checked="" type="radio"/> The activities/questions in the Think-Pair-Share phases are well connected.
<b>Deliverable in each Phase</b>	<input type="radio"/> There are no concrete deliverables (outputs) in any of the phases.	<input type="radio"/> Concrete outputs have been provided for some phases, but not for all.	<input checked="" type="radio"/> There are concrete deliverables (outputs) at the end of Think, Pair and Share phases.

## USE OF DEMO BASED LEARNING AS AN ACTIVE LEARNING STRATEGY

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### ABSTRACT

Teaching any topic with the help of a figure is worth a thousand words, and with a demonstration is worth a thousand figures. The idea behind demo based learning is that some topics are difficult to understand through text or static figures. These topics include processes with complex dynamics, speed, procedures, transformations etc. Demonstration can reveal processes that are too fast for students to understand, or too small to see. This paper explores the different ways of demo based learning in Instrumentation and Control Engineering. This aims to form simulated model of the dynamic process for a student. The demo based learning was conducted in a class. The feedback taken after the implementation shows that this type of learning stimulates the interest of the students promotes their engagement and increases their confidence.

### INTRODUCTION

In the past, teaching used to be more teacher centric rather than student centric. Also more importance was given to teaching and not to learning of the students. Conventional teaching used to be a one-way process rather than two way. Students used to be only in listening mode. Active participation of students during the lecture session was missing. The retention of the knowledge acquired during the lecture session was for a short period of time. Also the use of technology for teaching was limited. So it was difficult for the students to visualize difficult concepts. Chalk and Board was the only prominent mode of teaching. In this conventional mode of teaching, students used to have less scope for developing their thinking and analytical ability. Thus this conventional monotonous teaching mode limits active participation of students in class room activities and are left with merely listening to lectures continuously. [1] Earlier there used to be few premier institutes with high quality teachers imparting knowledge to limited number of able students. This resulted in good quality engineers which met the criteria of the Industry. But with the increase in number of institutes resulting into an increase in number of engineers, the quality degraded. Readiness of the graduate engineers for industry was hampered. Lack of skill sets among the graduate engineers was observed. Expectations of the industry from engineering education have grown over past years. The engineering education is expected to prepare students for solving real world problems/situations. Students must be provided with such opportunities to acquire competence in team building, interaction, and interdisciplinary skills during their college education. [2]. So need for change in the engineering education system was realized. Continual efforts in this direction resulted in development of Outcome Based Education (OBE) system.

Accreditation of engineering institutes by statutory bodies like NBA NACC etc helps to check the implementation of Outcome Based Education (OBE) system in the institutes. As per the ABET Criteria 2000 accreditation, engineering programs curricula should be strongly influenced by the requirements of the industry. Two recent studies by engineering educators, sponsored by National Science Foundation and National Research Council, emphasize the need to frame engineering curricula to meet industry requirements. [2] Importance of teaching learning, Students engagement in the classroom sessions, development of knowledge, problem solving skills and attitude among students, readiness for industry are of prime importance in this system. The measurable outcomes of the engineering program and of a particular engineering branch are well defined. The curriculum design/structure, the teaching methodology and the assessment and evaluation is all aimed at achieving these outcomes.

In all this the teaching learning process plays an important role. Over the years several techniques and tools have evolved to improve the students learning and engagement. Advancement in the technology has contributed greatly to this. Flipped classroom, Think pair Share(TPS), peer instruction, project based learning, problem based learning, case study based learning, demo based learning, Activity based learning (role play, crossword, quiz etc), inquiry based learning are most commonly used as best teaching practices to enhance the teaching learning process. In this paper, demo based learning teaching pedagogy is explored for effecting teaching learning. The paper includes sections which cover various aspects of Demo based learning teaching pedagogy. It includes the definition of demo based learning, various ways to implement demo based learning, methodology adopted, observation or feedback and impact analysis. The findings that have been experienced while experimenting with this teaching pedagogy are presented in the paper.

## RELATED WORK

In paper [3] has presented instances where concerns regarding the quality of engineering education is raised through references [4, 5]. The paper [3] compares the conventional teaching method framework with the framework of proposed pedagogic change. In this work, teaching learning pedagogies like collaborative learning, peer learning, technology enabled learning and participative learning strategies are explained. The impact of incorporating these innovative methods is assessed using students' feedback, course end survey. A significant improvement in the student performance was found with the use of these techniques.

In [6], to enhance the quality of engineering education Information and communication technology (ICT) based teaching was experimented. ICT based teaching included video lecturing, discussion forums, change in assessment pattern, industry partnership courses to check its effectiveness. In [7], Collaborative learning is employed for programming course in a E-learning environment. In this the author has assessed the student performance using metrics such as knowledge sharing, level of learning, work experiences and overall productivity. The author observed a significant improvement and has claimed that collaborative learning can be used as pedagogical tool to enhance teaching learning capabilities in a programming course. The author of [8] found that peer learning pedagogic tool helped in learning through peers, colleagues, students in and outside the university and resulted in improved skill set in a research environment. Amira et.al [9] analyzed the learning behavior of students and found that different learning strategies such as participative learning, competitive learning and cooperative learning gained significance among the student community. The author of [10] found that cooperative learning style developed the capability of students to work in a team. Also significant improvement in scores of students was observed with cooperative learning style. Activities such as role-plays, games, case studies, usage of tools were implemented under activity based learning pedagogy. [11]. Feedback taken showed that students were more satisfied with activity based learning against conventional learning method.

Collaborative learning which is a group activity that involves students working together to obtain solution is discussed in [12]. In participative learning, both the teacher and students are actively involved in improving the teaching learning process. It helps to build a good relationship between teacher and students [13]. Technology enabled Learning involves MOOC courses offered by Coursera, edX, NPTEL are of high standards is more popular nowadays since the current generation of students are more tech-savvy [14].

## DEMO BASED LEARNING

Demonstrations are practical presentations of processes/procedures/skills which are designed to explain various theoretical principles. Demonstrations require careful planning along with oral and visual explanations, appropriate illustrations to clarify concepts. The demonstration based teaching can be done in different ways as shown in Figure 1.

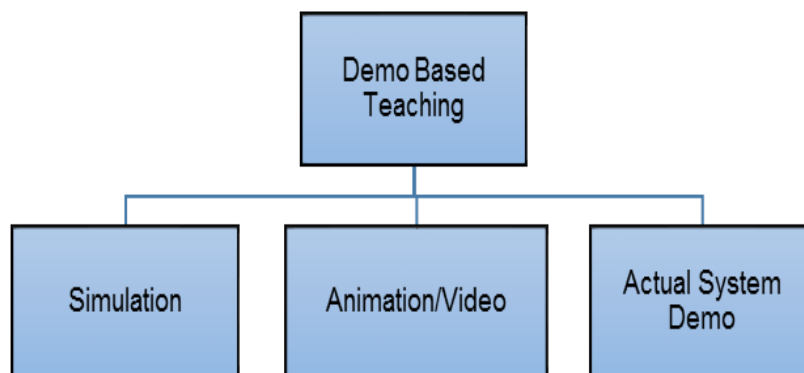


Figure 1: Different ways of Demo Based Learning

The different ways of Demonstration are explained in detail.

### 3.1 Simulation

Simulations are instructional scenarios where the learner are placed in a virtual environment. Students experience the reality of the scenario and gather meaning from it. Simulations form a bridge between the theoretical learning and practical implementation. Simulations can be implemented using the following few ways:

- a game – puzzle etc.

- a role-play- e.g. Arbitrary waveform generator, Stack of microcontroller etc.
- simulation softwares-e.g. circuit design, testing etc.

Simulation can be shown with software like National Instruments NILVIS, Pspice, and Proteus for simulating electronics circuits like gates, counters, op-amps and systems like CRO, FFT analyzer and Spectrum analyzer. Different biomedical and process concepts can be explained with the help of Virtual Laboratories. In process instrumentation designing circuits using different hydraulic and pneumatic components can be shown in the automation software tools.

### 3.2 Animation/Video

Animations/Video can help learners understand topics difficult to visualize. Animations are useful to develop interest among the students and promotes their engagement. They help to abstract ideas more accessible. Teachers wishing to adopt this approach should be able to find appropriate animations on the Internet, or they may need to design their own. Following are the topics which are explained using animation /video in Instrumentation and Control Engineering:

- Angiography, Dialysis, MRI Principle, Imaging techniques which are difficult to visualize and actual demo is not possible can be understood easily
- Similarly, operation of motors, semiconductor devices, vortex flowmeters can also be animated
- Also videos on automation of industrial processes found in power plants, food and beverage plants etc can be shown to know the applicability.

### 3.3 Actual System Demo

By this activity the students get to know hardware implementation of the concepts they study and get hands-on experience on actual students get to know hardware implementation instruments and pilot plants. They get to know the operational details of the instruments. Following are the topics which are explained using actual system demonstration

- Pneumatic and hydraulic trainer kits can demonstrate the working of circuits studied in class. Students get a feel of the actual components and the connections.
- Cut sections of components or machine can help in getting a better insight of the internal components of complex machines.
- Basics of ultrasound and various scanning modes can be demonstrated on actual set up.
- Implementation of different control Strategies on actual hardware can be shown Inverted pendulum setup. Feedback, cascade feedforward control strategies on pilot plants.
- Controls on a Thermal Camera or different operational modes can be actually demonstrated.

## IMPLEMENTATION

Second Year B. Tech Instrumentation and Control curriculum, includes course titled 'Basic Instrumentation'. In this course students study construction and working of Test Instruments. One such test instrument is Cathode Ray Oscilloscope (CRO). This test instrument is extensively used for testing and analysis of various electronic circuits in various laboratory sessions, mini-projects and projects by the students. This instrument has many controls and the students should be able to handle these controls efficiently for proper analysis and testing. The functioning of these different controls are supposed to be covered in the theory course. In a class room session, it becomes difficult for the students to visualize the effect of each control. If the effect of change in the setting of each control on the CRO is demonstrated, then it becomes easier for the students to understand, remember and reproduce it. The activity was conducted as shown in Figure 2.

## INSTRUMENT: SURVEY QUESTIONNAIRE

The student feedback regarding this activity was conducted using following questions:

1. Do you think the demo based teaching helped in understanding the concept in depth than the conventional teaching?
2. How confident you will be now while using the instrument?
3. Will you be able to correlate the controls of the instrument with the internal circuitry of the instrument?
4. Do you feel this method is appropriate for the topic and are very useful?

## RESULTS ANALYSIS AND DISCUSSION

The feedback taken after the completion of the demo based learning was analyzed with the help of the graphs shown in Figure 3.

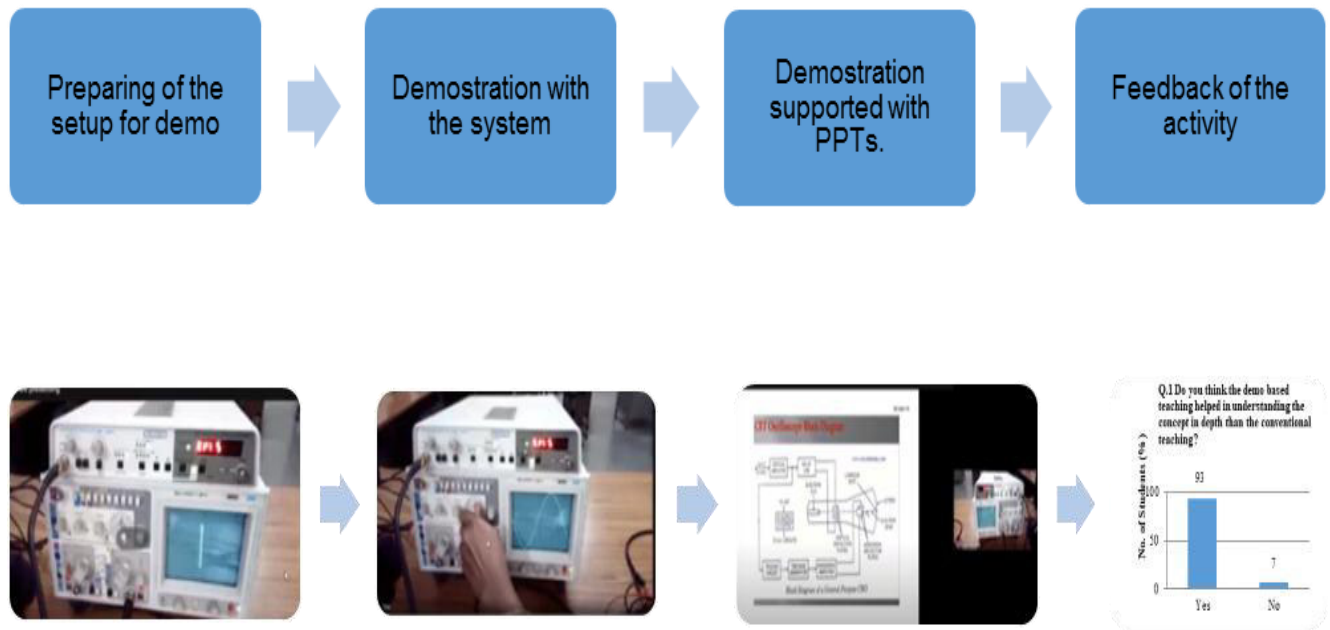
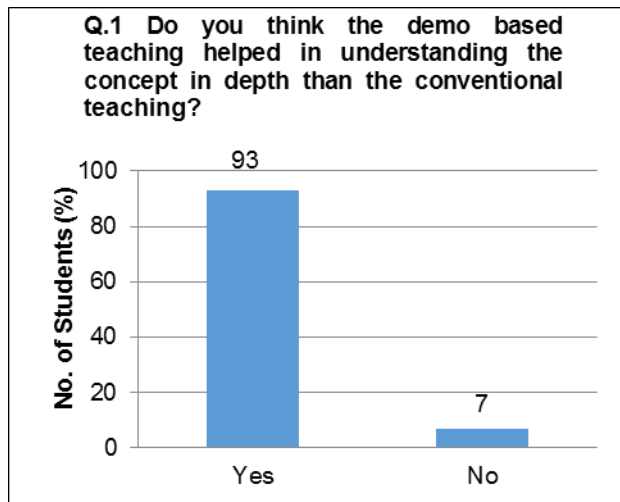
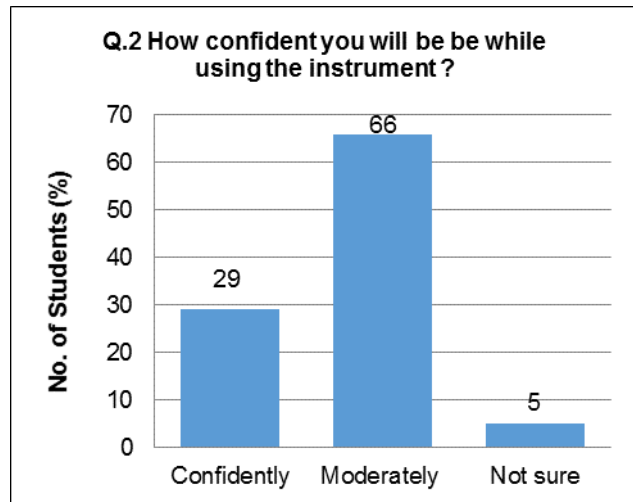


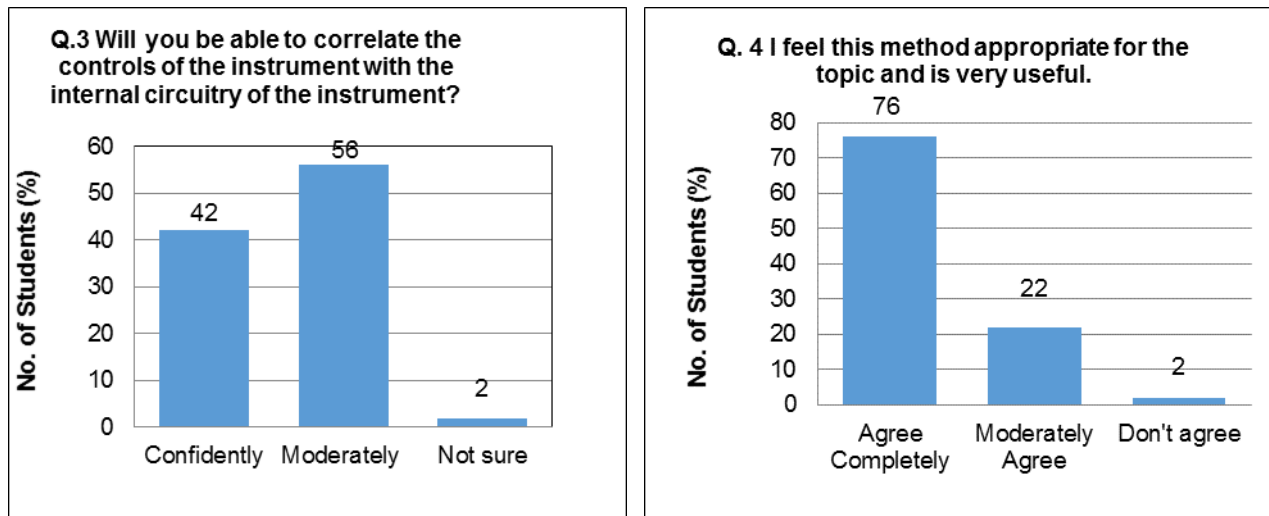
Figure 2: Steps in Demo based learning using actual system demonstration with example



(A) Response to Q.1



(B) Response to Q.2



(C) Response to Q.3

(D) Response to Q.4

Figure 3: Responses of the questionnaire

The responses to all the questions indicate that the students understood the working of CRO in depth. More than 95% of the students are confident in handling the instrument before going for the lab session. More than 98% of the students can correlate the controls discussed in the demonstration with the circuitry shown in the presentations. More than 98% students found interest in this topic because of this activity.

Demo based learning facilitates effective learning of concepts which are difficult to visualize. Simulations can foster an exciting, energetic and engaged teaching environment. Learning a set of concepts in less time is possible. Change in instructional procedures helps to gain and keep student's attention. It is more enjoyable and its practical nature leads to greater student participation and satisfaction. It is applicable to almost all subjects of second, third, and final year students. In spite of the above advantages there are some limitations of demo based learning. In certain cases, simulation software/equipment/models can be expensive. They require constant updates and maintenance. The technique can be unsuitable in certain cases where the problem can be solved by common sense, analytically or through direct experiments. Optimal solutions cannot be obtained by simulations. In simulation the students may not encounter the real consequences that might result from human errors. To develop a good simulation model, more efforts are required.

## CONCLUSIONS

In the paper Demo based learning pedagogy is studied. There are three ways in which this pedagogy can be used. In this paper actual system demonstration way of demo based learning was experimented. For impact analysis of the activity conducted, feedback from the students was taken. The responses obtained show that the students found the activity apt for the topic. Also this activity led to better understanding of the topic. On similar lines the other two ways of demo based learning can be explored.

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## USE OF FLIPPED CLASSROOM MODEL AS AN ACTIVE LEARNING APPROACH TO TEACH INFORMATION THEORY AND CODING TECHNIQUES

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### ABSTRACT

The purpose of this paper is to explore the “flipped” or “inverted” classroom and its effects on student learning. The flipped classroom is a form of education in which students learn new content during out-of-class-time instead of the traditional review exercises that are normally given, which opens up class time for activities, problem solving, and other forms of instruction. During this study, a flipped classroom was implemented in the Electronics and telecommunication program’s ‘Information Theory and Coding Techniques’ course at Third year level. Students are evaluated in in-class activity during class sessions / discussion and in out-class activity with help of responses received on questionnaire posted on Google classroom. The concept of topic on source coding techniques- Huffman Coding and Lempel Ziv coding were recorded with help of ‘Active Presenter’ a screen- cast tool. The recorded video was shared with students on Google classroom along with and my personal notes from teaching. The outcome of flipped classroom learning indicate that some potential benefits of the flipped classroom make it a form of education that teachers should consider for better teaching – Learning progress.

### INTRODUCTION

The flipped classroom Model also referred to as ‘*inverted learning*’ is a new pedagogical model where the instructor shares predetermined digital resources with students through a platform outside the classroom, and related content is also taught through this outside platform asynchronously [1]. Inside the classroom, active, collaborative, and interactive problem-solving activities and consolidation practices are carried out [2]. Thus, learners are more active in the class, internalizing the contents through a wide range of classroom tasks [3]. In [4] contended that a flipped classroom is an educational technique which consists of two significant components: (1) the use of computer technologies such as video lectures and (2) the involvement of interactive learning activities.

The study of flipped classrooms was based on the theory of Bloom’s revised taxonomy of cognitive domain. This taxonomy provides six levels of learning. The explanation is arranged from the lowest level to the highest level:

1. Remembering: in this stage, the students try to recognize and recall the information they receive; they also try to understand the basic concepts and principles of the content they have learned.
2. Understanding: the students try to demonstrate their understanding, interpret the information and summarize what they have learned.
3. Applying: the students practice what they have learned or apply knowledge to the actual situation.
4. Analyzing: the students use their critical thinking in solving the problem, debate with friends, compare the answer with peers, and produce a summary. The students obtain new knowledge and ideas after implementing critical thinking or a debate in group activities. In this level of learning, the students also produce creative thinking.
5. Evaluating: assessment or established peer-review knowledge, judge in relational terms; in this stage, students are evaluating the whole learning concepts and they could evaluate or make judgment on how far they successfully learned.
6. Creating: the students are able to design, construct and produce something new from what they have learned [5].

In implementing flipped classroom, remembering and understanding as the lowest levels of cognitive domain are practiced outside the class hour [6]. While in the classroom, the learners focused on higher forms of cognitive work, including applying, analyzing, evaluating, and creating. The following Figure 1 and Figure 2 illustrates the level of students’ learning in Traditional Model and in the flipped learning according to Bloom’s revised taxonomy.

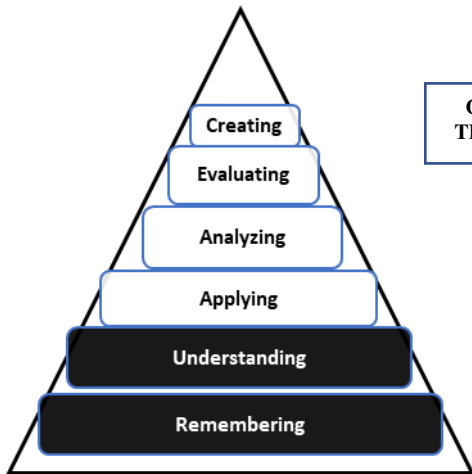


Figure 1: Traditional Model

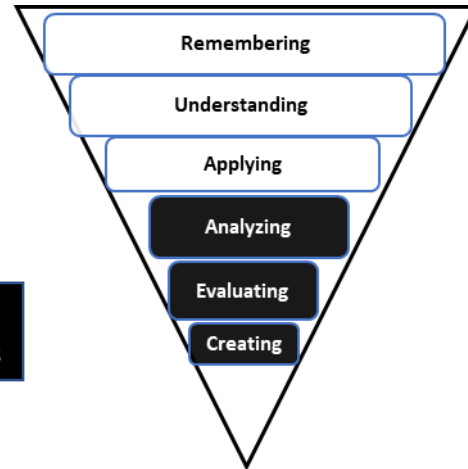


Figure 2: Blooms revised taxonomy in Flipped Learning Model

With the flipped model, the lower levels are presented before class through recorded lectures and video. Readings, simulations, and other materials also provide this foundational support for learning so that in-class time can be spent working on higher levels of learning from application to evaluation. In flipped classrooms, students go from the lowest level (remembering) to achieve the highest level (creating). [7] mentioned that the flipped classroom focuses on how to support the learners in achieving a higher level of the taxonomy domain. Additionally, [8] added that in flipped learning, classroom activity is spent on application and higher-level of learning rather than listening to lectures and other lower-level thinking tasks. As shown in Table 1, implementing flipped learning allows the students to spend more time supporting higher-level learning tasks such as a group discussion, while lower-level tasks such as knowledge and comprehension are completed independently outside the class.

Table 1 Comparison Between Traditional Classroom and Flipped Classroom in Achieving Higher Order Thinking of Bloom’s Taxonomy

Level of learning	Traditional classroom tools	Flipped classroom tools
<b>Remembering</b>	Face-to-face lecture	Pre-recorded lecture, reading material, and watching video lectures independently
<b>Understanding</b>	Question and Answer	Reflection, peer-to-peer discussion and collaboration
<b>Analyzing</b>	Homework	Classroom activities such as a group discussion
<b>Applying, Evaluating, Creating</b>	Homework or nothing	Student projects, presentations, peer-evaluation and instructor-evaluation.

The flipped learning provided various benefits and challenges for students and instructors. The benefits can be listed as flexibility, improvement in interaction, professional skills, and student engagement. Challenges included increased workload for faculty, student resistance, lack of opportunities for just-in-time questions, technical issues, decreased interest and neglected material.

## RELATED WORK

The first article on flipped learning using the term “*inverted learning*” was published in 2003. From 2013, flipped learning started sparking more interest amongst engineering education researchers. There is an increase in the number of engineering courses being converted into a flipped format after 2012 [9]. For example, in [10] it is found that students in the flipped segment performed significantly better than the ones in the traditional segment during the first year that the flipped approach was implemented, but this difference was not statistically significant in the second year.

One of the most commonly cited benefits of flipped learning was flexibility in [11, 12]. An added value of the flipped approach was being able to rewind and re-rewind the lecture videos. Students could pause and rewind the videos, take notes and solve example problems while watching the lecture videos. Having access to course materials for 24/7 provided flexibility for students with different learning preferences and personal commitments. This flexible teaching and learning environment also created time for complex problem solving [13] and opportunities to cover more materials [14]. The rationale behind flipped learning is to use face-to-face class time for complex exercises where students can interact with each other and with the instructor. This synthesis concluded that students enjoyed working with their peers [15] and having the instructor available for help [16]. Student-centered instructional approaches, like flipped learning, not only help students learn the content but also provide opportunities to improve professional skills that “today’s competitive global market and changing work environment demand engineers to possess” [17]. Another benefit revealed was student engagement [18]. Researchers found that students came to class better prepared [19], and they devoted more time and formed better study habits compared to traditional classroom approaches [20].

As with any new approach, flipped learning brings some challenges for instructors and students. The biggest challenge for instructors was the heavy workload prior to and during class. Converting a course from a traditional teaching approach to a flipped format required a reasonable amount of front-end investment from faculty members [15][21]. During class, on the other hand, one instructor had to serve many students requesting assistance [16]. Challenges for students included uninteresting online material, technical issues and insufficient knowledge about the new approach. The length of the videos contributed to lack of interest in the material [22]. Other researchers found that students could easily skip some of the materials in the flipped classrooms. In [23] indicated that rather than watching the videos, students read the slides. Although it is generally accepted that today’s net generation students ubiquitously use various technological tools and applications in their daily lives, the technical issues frustrated students [24]. Student resistance was another challenge that flipped learning instructors faced. Having gone through a traditional approach throughout their educational career, students felt overwhelmed when faced with a new approach that required them to actively participate in the learning process [25]. Students who lacked metacognitive and organizational skills struggled in flipped classrooms [26]

## Methodology and Implementation

The template for flipped classroom conduction is shared with faculty, this template is constructed with template shared during FDP201x Foundation Program in ICT for Education organized by IIT Bombay.

Initially a brief review of the topic selected is presented which depicts its need for better learning outcome.

In Information Theory and Coding Techniques course, Information theory studies the quantification, storage, and communication of information. It was proposed by Claude E. Shannon in 1948, in a landmark paper entitled "A Mathematical Theory of Communication". Applications of fundamental topics of information theory include lossless data compression (e.g. ZIP files), lossy data compression (e.g. MP3s and JPEGs), and channel coding (e.g. for digital subscriber line (DSL)). Maximization of information transferred i.e. data compression is basically done with Shannon fano, Huffman and Lempel ziv coding techniques called Source coding. Message protection and channel adaptation; increasing reliability and fidelity is achieved through Block code, Cyclic code, Convolution code, Bose - Chaudhuri – Hocquenghem (BCH) Code, Trellis Coded Modulation techniques called Channel coding. The source coder reduces redundancy to improve efficiency, whereas the channel coder adds redundancy in a controlled manner to improve reliability.

The flipped classroom learning activity is addresses to study Source coding technique – Huffman and Lempel ziv techniques. Thus evaluating a Course Outcome: Apply Shannon Fano, Huffman and Lempel Ziv techniques for data compression.

The Procedural steps commonly used for implementing Flipped Classroom activity is given in Figure 3.

In **Step I:** The source coding technique applied to compress data – Huffman and Lempel Ziv are addressed. The learning outcome is: How students will be able to Apply Huffman coding to probabilistic data and Lempel Ziv technique for non-probabilistic binary and textual data for efficient data compression.

In **Step II:** After planning topic to be covered, the preliminary study material for students to refer before attending lecture in classroom is shared through Google classroom. My personal notes and animated presentation were posted on Google classroom for students to refer as in Figure 4 and Figure 5.

In **Step III:** Also a video recording covering concepts was done on “Active Presenter” screen-cast tool and posted on Google classroom. [27]. The Key concepts are also explained.

In **Step IV:** After watching video a questionnaire regarding content in video is asked to check students Learning. This is out-of-class activity which covers low cognitive level - Understand and Apply Blooms level.

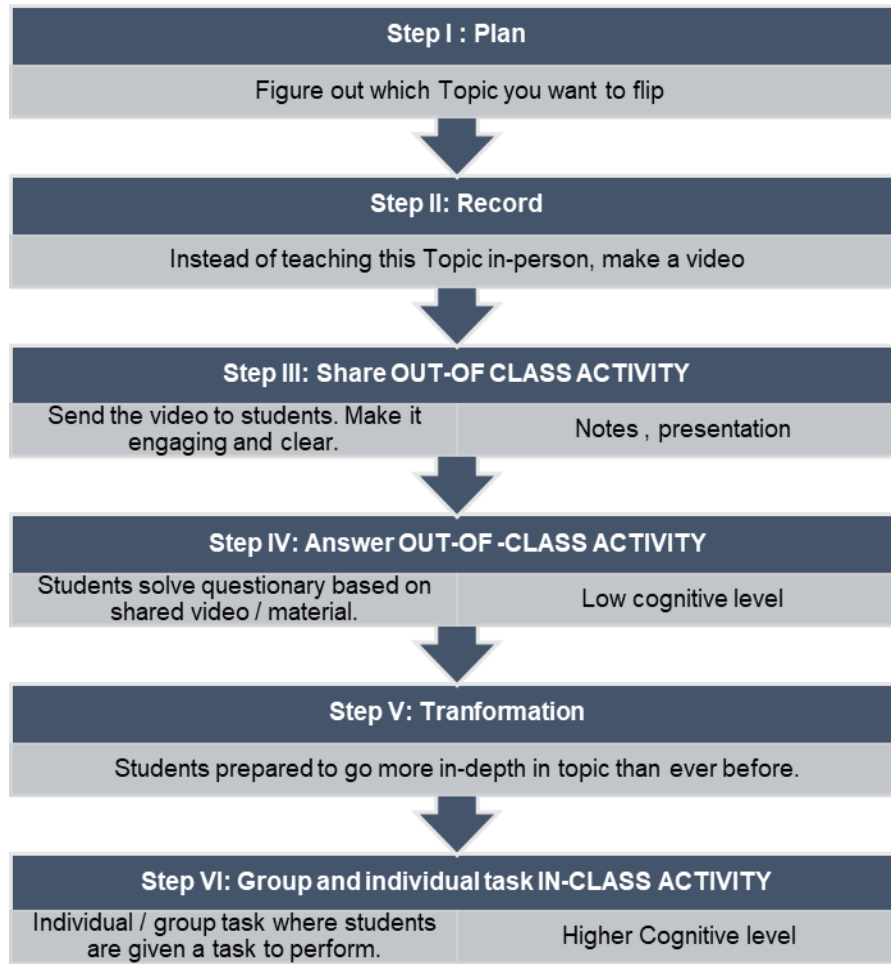


Figure 3: Procedural steps commonly used for implementing Flipped Classroom activity

Example of Huffman Encoding.

$x_i$	$P(x_i)$	CODE
X1	0.30	00
X2	0.25	01
X3	0.20	11
X4	0.12	101
X5	0.08	1000
X6	0.05	1001

$H(X) = 2.36$  b/symbol  
 $L = 2.38$  b/symbol.  
 $\eta = 0.99$

Merging

Splitting:

Lempel-Ziv Algorithm

Parsing the source data stream into segments that are the shortest subsequences not encountered previously.

- "Universal code" -works without knowledge of source statistics.
- Parse input file into unique phrases.
- Encode phrases using fixed length codeword, variable to fixed length encoding (suitable for synchronous transmission.)
- Decoder can uniquely decode the send sequence.
- Code rate approaches the source entropy for large sequence
- Dictionary size must be chosen in advance so that the length of the codeword can be established.(12 bits—4096 entries)
- Algorithm inefficient for short sequences.
- Used : encoding binary/text files, compress/uncompress software for PCs.

Figure 3: Huffman Coding

Figure 4: Lempel Ziv Coding

In Step V: After refereeing to study material and watching video students are now prepared for in- class activity with higher cognitive level.

In Step VI: Students are asked to answer the questionnaire with expected time duration. (Table 2) They were asked to solve it individually initially. Then discussion on the possible solution with peers was conducted. Following Questions are attempted by students in in-class activity

**Table 2 Questionary for IN-THE-CLASS activity**

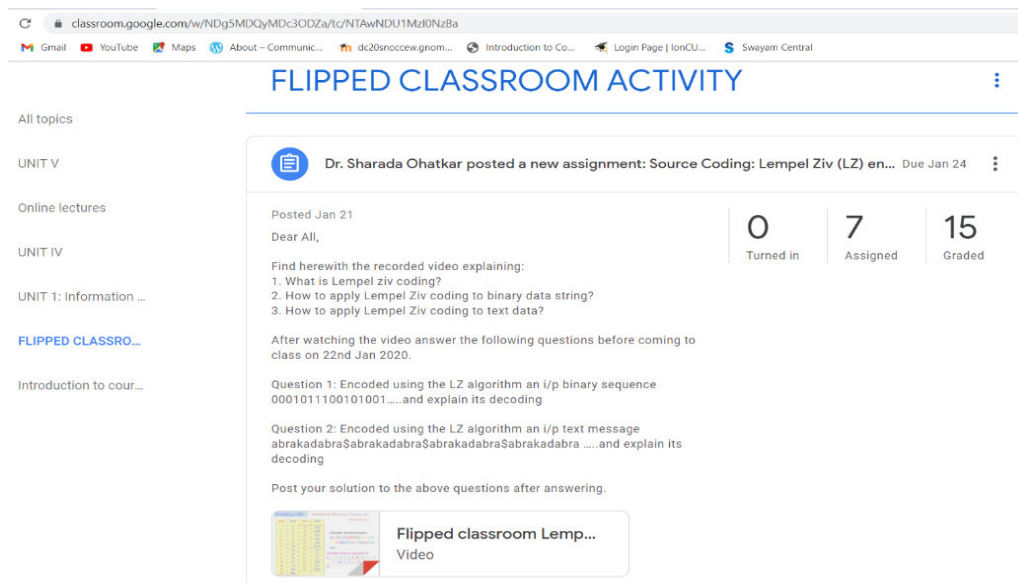
Learning Objective	Assessment Strategy	Expected Duration (in min)	Additional Instructions (if any)
How to apply Huffman coding and find its efficiency	Q. For a DMS source with six symbols. Find a compact code for every symbol if probability distribution is $P(x_1) = 0.3$ , $P(x_2) = 0.25$ , $P(x_3) = 0.2$ , $P(x_4) = 0.12$ , $P(x_5) = 0.08$ , $P(x_6) = 0.05$ . Calculate entropy of source, average length of code, efficiency and redundancy of code.	10 minutes	Watch V1 and then answer Q1
How to apply Lempel Ziv coding to binary data?	Encoded using the LZ algorithm an i/p binary sequence 0001011100101001.....and explain its decoding	10 minutes	Watch V2 and then answer Q2
How to apply Lempel Ziv coding to text data?	Encoded using the LZ algorithm an i/p text message abrakadabra\$abrakadabra\$abrakadabra\$abrakadabra....and explain its decoding	15 minutes	Watch V2 and then answer Q3

At the end of the class, students will be able to, Analyze the performance of Shannon-fano coding and Huffman Coding (ANALYZE Level) and How to find the code for binary string and Text without probabilistic data (ANALYZE Level)

### Evaluation

Students attempt the questionnaire based on topic during in-class activity based on higher cognitive level. Also, in out-of-class activity with low cognitive level. Students then post it on Google classroom. The students work is assessed based on Illustration, method for solving, conclusion, comment and Timely completion.

Figure 6 shows the out-of -class activity to be completed by students before attending concerned lecture also shows shared study material and recorded video. Figure 7 shows students responses posted to the questionnaire for in-class activity. Figure 8 a and 8b shows assessment and marks obtained by students on Google classroom.



**Figure 6: Out-of -class activity in flipped classroom**

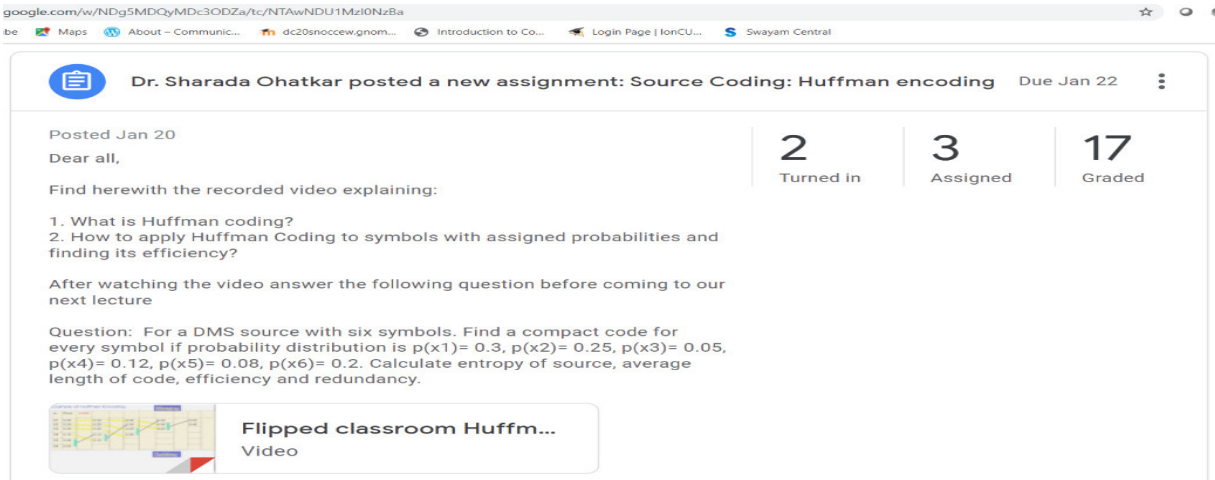


Figure 7: Students responses posted at Google classroom

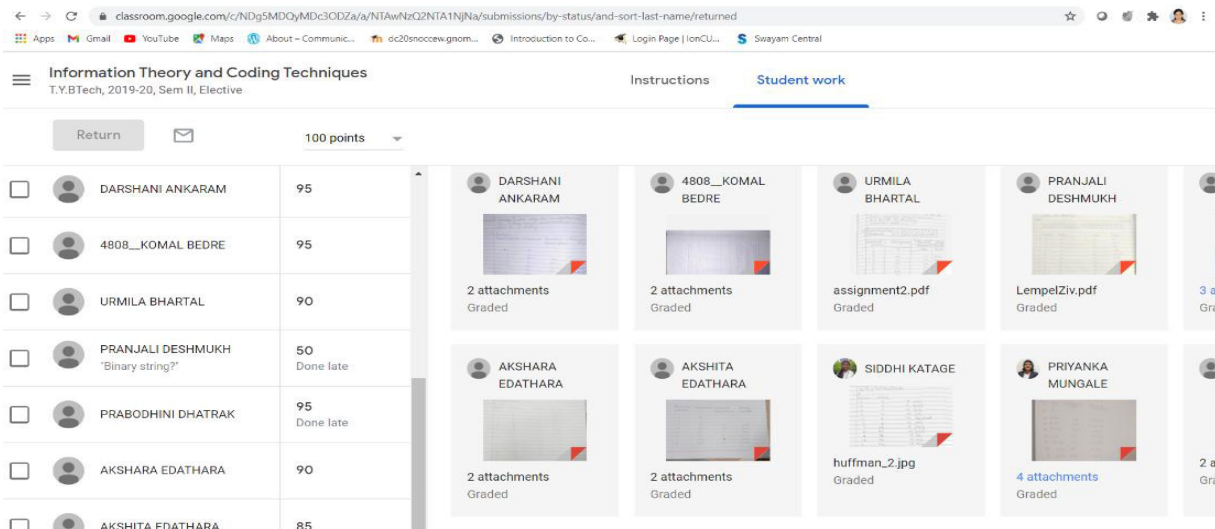


Figure 8a: Assessment and marks obtained

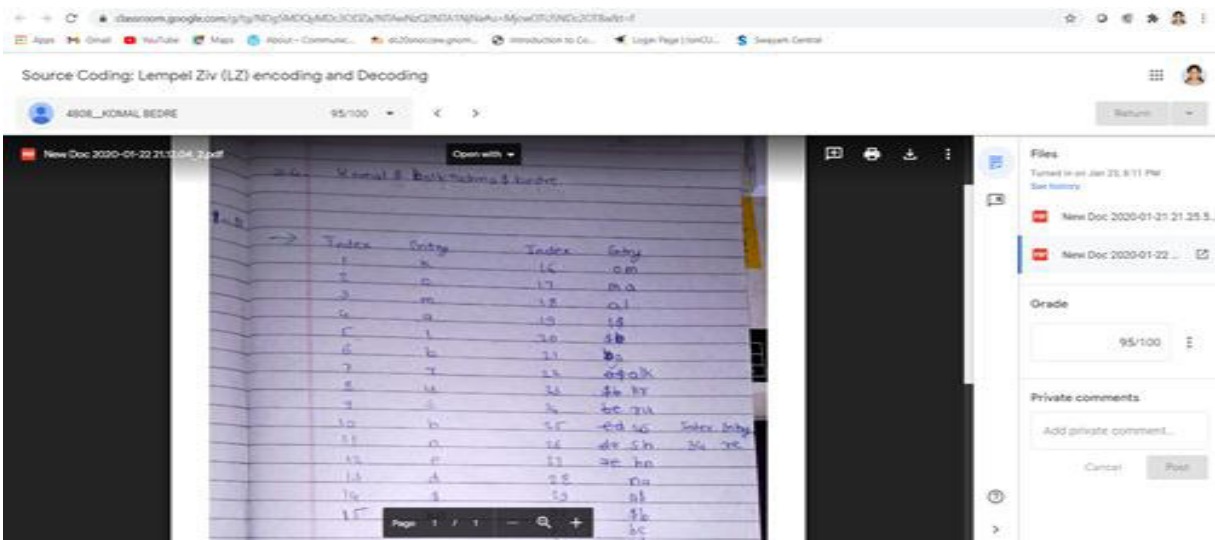


Figure 8 b: Assessment and marks obtained

## Results Analysis and discussion

The students took a survey about their class participation and confidence at the end of the Flipped classroom study. The survey questions are

1. I enjoy sharing my thoughts and observations during class discussion in Information Theory & Coding Techniques class
2. After watching video and referring study material provided helped me to learn concepts
3. Discussing my solution with my partner in-the- class activity helped me to learn concepts
4. Listening to other students' solution and discussion during in-class activity helped me to learn concept
5. I feel confident in my abilities for analyzing coding problems
6. I feel confident in my ability to contribute to class discussion on analyzing coding problem
7. I often participate in discussion in class for Information Theory and Coding Techniques
8. I am comfortable for contributing to discussion in class for Information Theory and Coding Techniques
9. Did you like the Flipped classroom activity?

Below, are charts from Figure 9 to 16 comparing the answers students selected in the pre-survey and post-survey on Flipped classroom study.

The survey questionnaire had Strongly disagree, Disagree, Slightly disagree, Slightly agree, Agree, and Strongly agree options. It is found that students have selected among Slightly agree, Agree, and Strongly agree. Response to questions showed an improvement in the post-survey compared to the pre-survey.

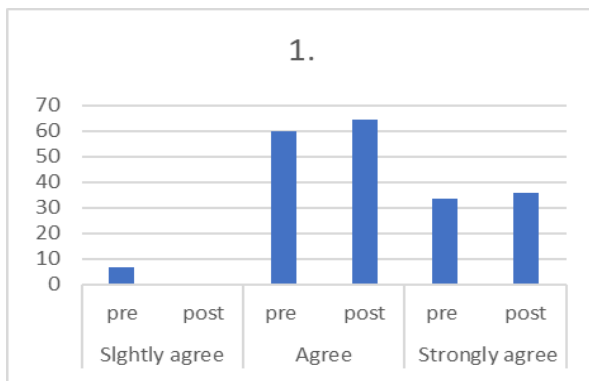


Figure 9: Response to Question 1

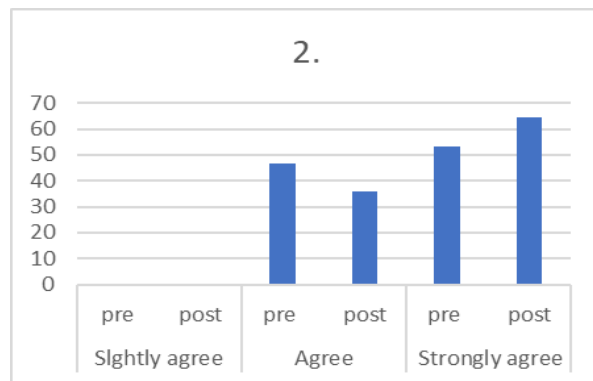


Figure 10: Response to Question 2

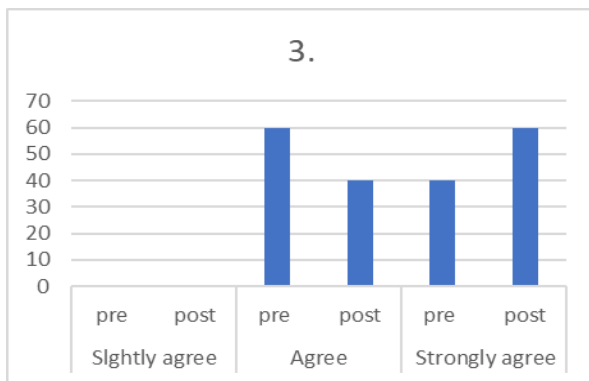


Figure 11: Response to Question 3

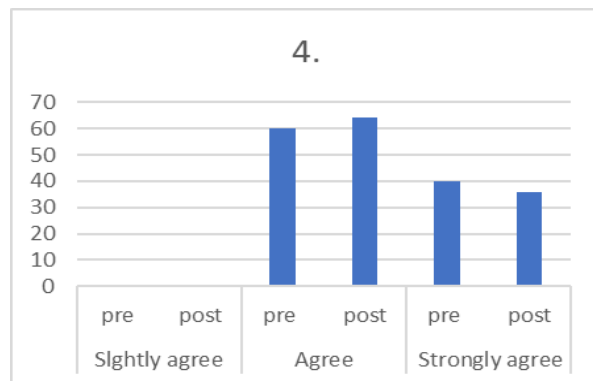


Figure 12: Response to Question 4

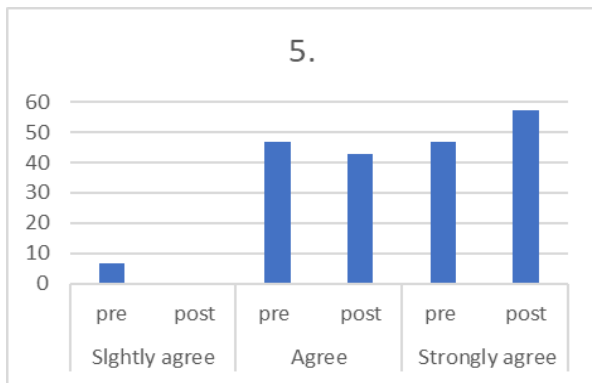


Figure 13: Response to Question 5

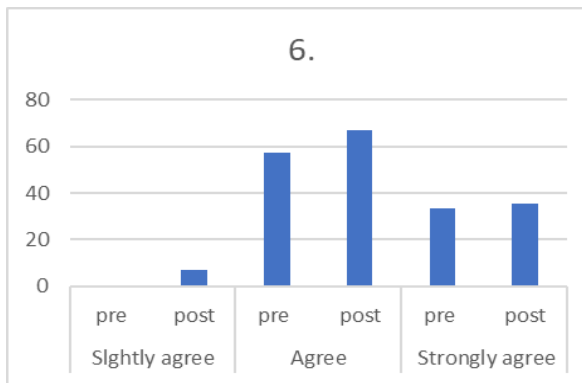


Figure 14: Response to Question 6

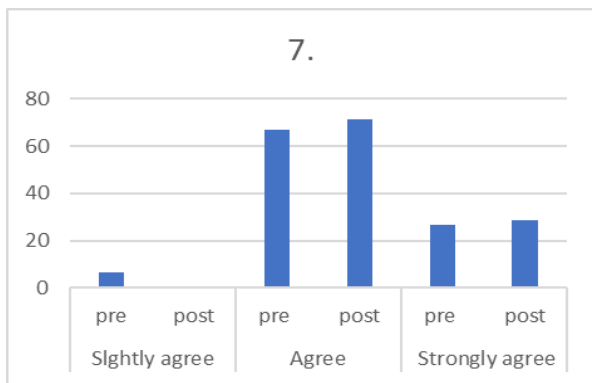


Figure 15: Response to Question 7

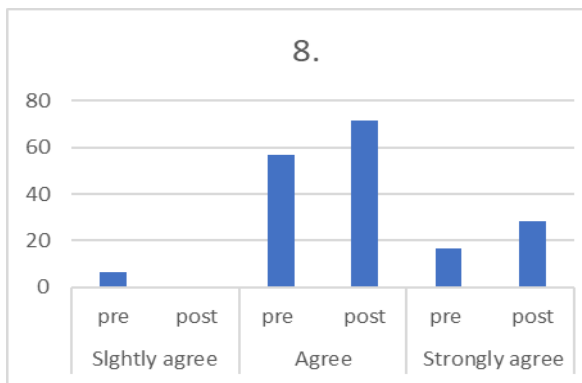


Figure 16: Response to Question 8

The response to the question at the end of questionnaire; Did you like the Flipped classroom activity? got 100% positive reply.

Response to the survey questionnaire, such as, 100% students agreed that Flipped classroom activity developed interest in them to learn. 100% students agreed that after watching video and referring study material provided helped them to learn concepts. 100% students agreed that discussing the solution with the partner and listening to other students' solutions during the in-class phase of flipped classroom helped students learn concepts more clearly. Further, also 100% students agreed that they found the Flipped classroom activity is effective. Students additional feedback on remarks if any questions were great learning experience, understood the concept well enough, explanation was in easy words, It was a different and good learning experience, learning the concept was easier, It was very useful.

## Conclusions

Final outcome of the research effort in terms of bringing in a sound conclusion of the effort should be mentioned over here in this section. Conclusion should contain, your own observations on approach towards innovative method adopted, hurdles you came across, methodology that you adopted to overcome these hurdles and future scope of improvement.

In this paper, how Flipped Classroom activity can be used for Course of Information Theory and Coding techniques is explained. Response to questions showed an improvement in the post-survey compared to the pre-survey. The results of the survey suggest that flipped classroom had a positive impact on students' views about participating in task in in-class phase. Response to the survey questionnaire, such as, 100% students agreed that Flipped classroom activity developed interest in them to learn. 100% students agreed that after watching video and referring study material provided helped them to learn concepts. 100% students agreed that discussing the solution with the partner and listening to other students' solutions during the in-class phase of flipped classroom helped students learn concepts more clearly. Further, also 100% students agreed that they found the Flipped classroom activity is effective. In addition, students agreed that they felt more confident in analysing problems and also confident in contributing to class discussion. In response to remark's if any question of survey, student's response is 'Flipped classroom helped me prepare for the discussions we had in class better, and also allowed me to revise directly from the lecture shared with



us'. The Flipped classroom activity is one of the optimal instruction techniques for teaching course like Information Theory and Coding Techniques.

## Acknowledgment

I would like to thank entire team of AICTE approved FDP101x: Foundation Program in ICT for Education and FDP201x: Pedagogy for Online and Blended Teaching-Learning Process, IIT Bombay and mentor. I am also thankful to Management, Principal and head Electronics & Telecommunication Engineering, CCEW, Pune.

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29. [Video 2: https://drive.google.com/open?id=1FGt0yivJE0ERIC\\_zblntf-48uLg93LYC](https://drive.google.com/open?id=1FGt0yivJE0ERIC_zblntf-48uLg93LYC)

## USE OF SPYMASTER GAME AS AN ACTIVE LEARNING STRATEGY TO TEACH MACHINE LEARNING KEYWORDS

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### ABSTRACT

Research in engineering education studies related to use of active learning methods are more focused on instruction in lab sessions. For large lecture classes have mainly concentrated on problem based learning, think, pair share, fish bowl and peer discussion. Gaming is a classroom-based active learning strategy. This paper explains the effect of use of Gaming as an active learning method during teaching to a large class for Machine Learning course of Information Technology under graduate program. Response to survey questionnaire showed improvement in the post-survey compared to the pre-survey. This suggests that learners believe using the gaming technique for learning. This gaming activity contributed to more student participation during discussion in ML class and increased their confidence.

### INTRODUCTION

With the modern era, it is important for the teachers to apply various teaching methodologies. Attention span of learners is decreasing day-by-day. They get distracted by digital gadgets and internet services. It is becoming difficult for the teachers to keep them focused in the class. They need to come up with innovative teaching methodologies. Student-centric learning has become inevitable in teaching-learning process. As a result, many pedagogic techniques are being practiced by teachers especially engineering teachers. The most commonly used techniques are: experiential-learning, design-based thinking, crossword solving, open-book tests, flipped classroom, think-pair-share activity and so on. It is important to innovate new pedagogic techniques and keep the excitement levels of learners high.

### RELATED WORK

Learning Machine Learning (ML) is a need of the hour. Tom Davenport and D J Patil have said that data scientist's job is going to be the sexiest job of the 21st century [1]. ML is at the heart of Data Science. Moreover, ML is being used by disciplines such as Mechanical Engineering, Civil Engineering, Chemical Engineering, Pharmacology, Sports Management, Computational Musicology and so on. As a result, ML has acquired lot of popularity and importance among learners. Every student aspires to learn basic ML. ML includes many techniques and algorithms such as classification, regression, clustering, association rule mining etc. All these techniques involve data-intensive computations.

To keep learners focused, a variety of pedagogic techniques are used by teachers while teaching ML. The most common techniques are flipped classroom, collaborative learning, presentations etc.

In flipped classroom pedagogic technique, the teachers explain the theoretical concept in the class [2, 3]. A URL for solving a simple (for example a one-dimensional) problem is recommended for self-studying. A problem similar to the self-learned problem but more complicated (for example two-dimensional) is given to solve in the class. The activity can be extended to a much more complicated (for example multi-dimensional) problem. This activity helps learners understand how to apply the known technique/algorithm to a more complex problem. As the learners participate in solving the numerical actively, they can establish relationship between the known and the new knowledge.

Collaborative learning technique helps learners learn from each other [4]. They can make decisions from the knowledge gained from other learners. To encourage this type of learning, an algorithm is discussed in the class, a numerical based on that algorithm is solved and finally the learners are asked to find the hypotheses of the algorithm. The class is divided into groups. Each group is given a clue about one hypothesis. The groups are asked to discuss 'for' and 'against' those clues and come up with the statements and conclusions. This activity gives a good opportunity to learners to get good insights into the algorithm. The learners learn strengths and weaknesses of the algorithm.

Learners present case-studies in presentation pedagogic technique. ML is applied in variety of applications across multiple domains. Social media, Uber pricing, face recognition, speech recognition, handwriting recognition, weather forecasting, traffic control, recommendation of songs/books etc. are some of the real-life applications of ML. However, there is a limit to the discussion of these applications in the class. The learners are encouraged to explore at least one such application and study how different steps such as data pre-processing, cross-validation steps, reporting, predicting are applied in the application of their choice. Learners are motivated to compare many similar applications and see how different algorithms are applied to do the same functionality. With this, the learners not only learn the different steps in ML process, ML algorithms but also the advanced versions of the algorithms they study in the class.

## METHODOLOGY

This is a game of guessing which words in a given set of words are related to the clue-word given by spymaster of the same team [5, 6]. The game has a board of  $n \times n$  grid. Each position in the grid contains a word. All the positions in the grid are filled with words based on certain theme. There are two teams playing the game. The members in the team can be two to four. One member in each team is a spymaster. This spymaster gives a clue word to the team. This word points to one or multiple words on the board. The other members of the team need to guess the word or words based on the clue word. The team members are required to guess the word or words that belong to their team. In that case, the team gets a point for every correctly guessed word. If the word belongs to the other team, the other team gets a point and the playing team loses its turn. In this way, the team which guesses maximum words is the winner. Figure 1 shows a sample 5x5 grid having ML keywords.































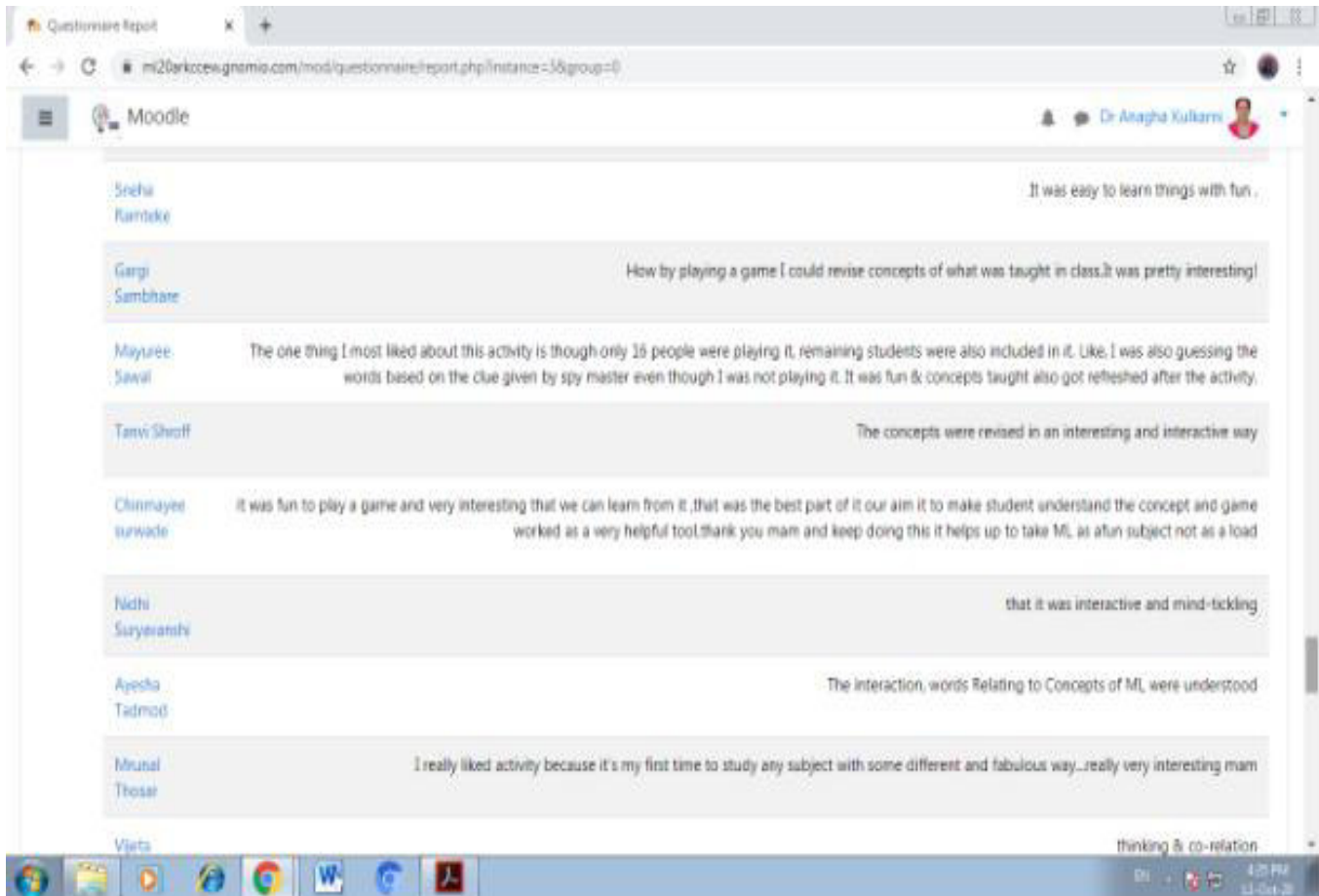
Intelligence 	Penalty 	Ambiguity 	Agent 	Model 	
Proportion 	Statistics 	Recall 	Cross-validate 	Cluster 	
Weighted 	Multi-class 	Unsupervised 	Semi-supervised 	Ratio 	
Assessment 	Exploitation 	Regression 	Actual 	Skewed 	
Retail 	Ordinal 	Exploration 	Probability 	Evaluate 	

Fig 1: A 5x5 grid

## RESULTS AND DISCUSSIONS

The game is used in engaging learners to identify the keywords and establish relationship among keywords in machine learning. The learners were able to establish relationship between two words. For example – if a spymaster of a team says ‘reinforcement 2’ (2 indicates 2 words related to reinforcement), it is likely that the team members may say ‘exploration’ and ‘exploitation’, however, these two words belong to different teams. If the spymaster says ‘risky reinforcement 2’, the team members may understand, the words are ‘exploration’ and ‘penalty’.



**Fig 2: Remarks of learners**

Learners liked this new way of looking at technical concepts. They found this technique interesting, helpful, innovative, refreshing and creative. They found it as a new way to co-relate the words. Figure 2 shows remarks of some of the learners.

## CONCLUSIONS

This was an all-inclusive activity. Although a few volunteers participated in this clue giving and guessing activity, the entire class of 76 students was involved in guessing the words as per the clue. They were testing their knowledge. The learners liked this new approach of learning.

It was very time-consuming to create multiple such grids. It had to be done in a thoughtful way. A micro-theme based such activities can be conducted for in-depth understanding of the algorithms.

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## ASSIGNMENT BASED LEARNING FOR THE COURSE OF MACHINE DESIGN

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### ABSTRACT

The important process in engineering teaching-learning is assessment. It is imperative that the assessment process should be well defined and effective. It should not only facilitate continuous evaluation but also motivate students for enhancing their performance. Conventionally, internal tests have been the widely used assessment technique for continuous assessment. However, these tests being too frequent in nature are monotonous and tedious. Such tests do not ensure deep learning and over a period hamper the students' interest in the course. An effective alternative is assignment based learning. This paper presents the details of assignment based learning practice adopted for the course of machine design of third year mechanical engineering. The methodology, case study, highlights and important features with the outcomes are discussed in this paper.

### INTRODUCTION

Conventional education system has teaching, learning and assessment as major components. [1]. From students' perspective, assessment is a measure of the extent to which she has learnt the course to the extent possible in line with the expected outcomes. It is recognition of her efforts, providing the basis for further improvements. For teacher, it lays the reflection of effectiveness of executing the teaching plan. It provides valid basis for measuring students' performance and also for improvisation of the approach towards the course. Thus, students' assessment is a crucial component of the teaching-learning process.

From learning perspective, the revised Bloom's taxonomy [2] [3], defines six progressively increasing learning levels, as Remember, Understand, Apply, Analyze, Evaluate and Create, which equips the instructor to adopt suitable methodologies for instruction, delivery and assessment<sup>[12]</sup>. Since 2014, our country is a signatory to the Washington Accord. The engineering programs need to ensure outcome-based education (OBE) approach<sup>[4]</sup>. Course Outcomes and Learning Outcomes are defined for every curriculum. Assessments mechanisms are created to ensure the OBE method. Course and Program learning outcome statements describe what students' attributes gained on completion of the program<sup>[6][7]</sup>. These relate to the knowledge, and skills that students acquire from the program. The course structure is arranged in a gradually increasing complexity<sup>[8]</sup>. Under OBE, students are expected to be able to do far better challenging tasks rather than memorizing and reproducing what was taught. Students are expected to be able to show their talents in imagining, questioning, researching and make decisions based on the findings. The role of the school adapts into educator, trainer, supporter, and mentor for helping students achieve the targeted outcomes<sup>[11]</sup>.

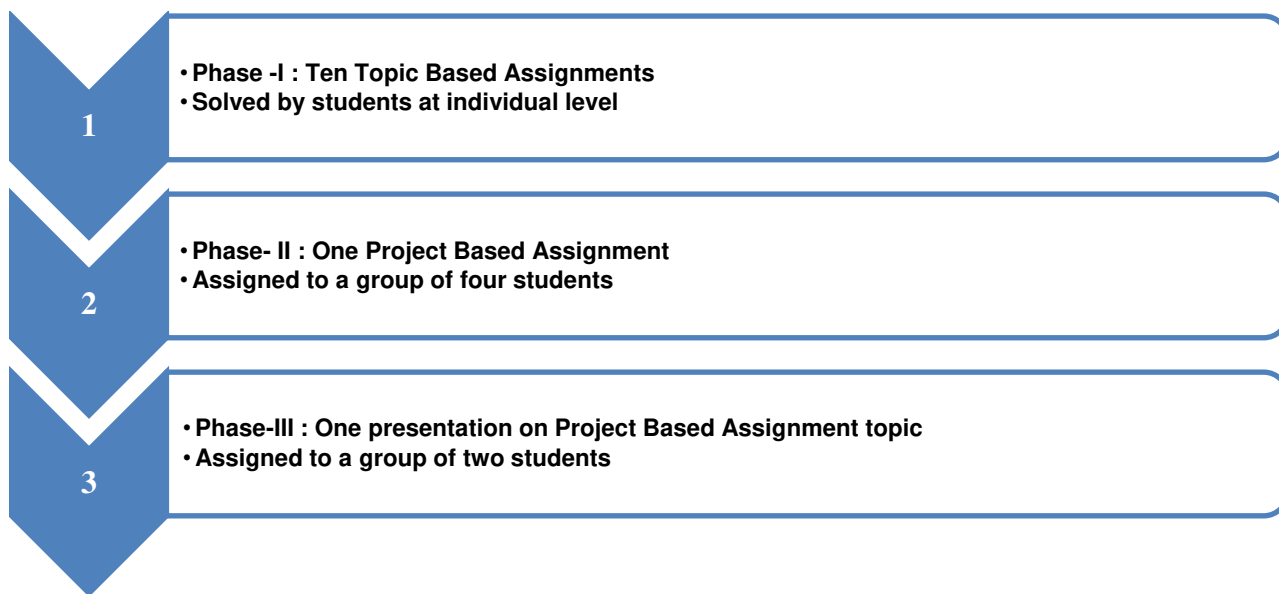
Variety of traditional assessment techniques are available [1][2][9][10]. Most of the conventional methods are memory based and repetitive thus unable to provide accurate and continuous assessment. One of the effective methods which encourage the students to learn in more focussed manner, motivates them to think rationally and enhances their analytical skills and innovativeness, is assignment based learning.

### METHODOLOGY

The course of Machine Design involves the scientific approach to formulate a layout/plan for a mechanical system to perform specific functions thereby fulfilling the need. The course deals with designing individual machine elements and the overall systems, through analysis of failure modes, material features, manufacturing aspects, cost considerations, along with maintainability and safety concerns. The broad scheme of learning-assessment for the 'Assignment Based Learning' for the course of 'Machine Design', is as follows

- i. Students are given the assignments during lab sessions based the progress of syllabus coverage during theory lectures.
- ii. Each assignment consists of 4 to 6 questions based on the concerned topic. The assignment is mapped with course outcome. Each question is mapped to aspects like memory based, conceptual, analytical and application based.
- iii. The students are allowed to refer the text books and class notes to complete the assignment and submit it on next turn.
- iv. The assignment is thoroughly checked and graded by the teacher. If necessary, the required corrections are suggested.

- v. Ten assignments are given in first ten weeks from the commencement of the semester. During this period, the students being well versed with the design of individual machine element are ready to take up a design project based on a practical application.
- vi. The students are divided in groups of 4 each and a project based assignment for the given practical application, is given to each group.
- vii. Each group does extensive brain storming to figure out the approach and to come up with strategy. Each group finalized their plan by discussing with the teacher.
- viii. Each group carries out the design starting from scratch and the process is done in a step by step manner. Each step is monitored and mentored by the teacher.
- ix. After completion, each group prepares a design report and drawings of the system, using suitable software package. The report and the drawings are assessed by the teacher.
- x. The batch is now divided in groups of two students each. Each group is assigned a topic related to the above project based assignment. The pair does a literature search and comes up with a power point presentation on the assigned topic. The presentations are assessed by the teacher.



### ASSESSMENT STRATEGY (RUBRICS)

#### Phase I: Assignments (Individual)

	Excellent	Average	Unsatisfactory
Contents (Correctness and neatness)	5	3	2
Understanding of topic	5	3	2
Timely completion	5	3	2

#### Phase II: Project Based Assignment (Group of 4 students)

	Excellent	Good	Average	Unsatisfactory
Critical Thinking, Analytical ability	5	4	3	2
Use of literature/sources	5	4	3	2



Project report and Drawings	5	4	3	2
Team Work	5	4	3	2

**Phase III: Assignment based presentation (Group of 2 students)**

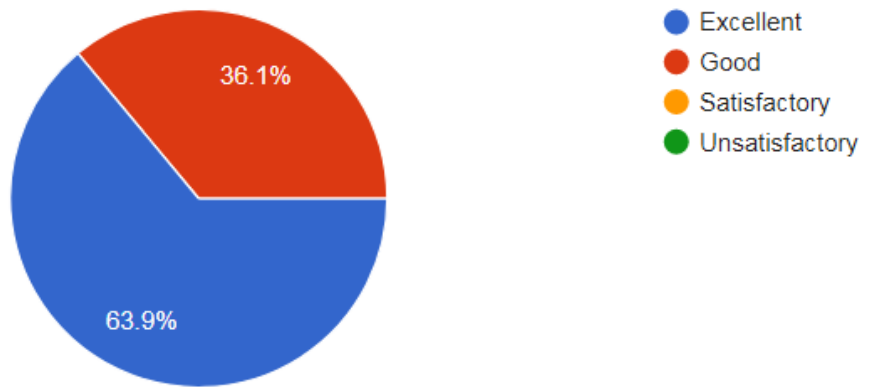
	Good	Average	Unsatisfactory
Technical contents	5	3	2
Slide arrangements	5	3	2
Presentation skills	5	3	2

**STUDENTS' FEEDBACK**

With the objectives to keep students engaged for learning through assignment based learning practice, findings related to analysis of effect of ABL activity on students, Survey Questionnaire as an instrument is used. Discussions next is related to responses that I got and its details are as follows.

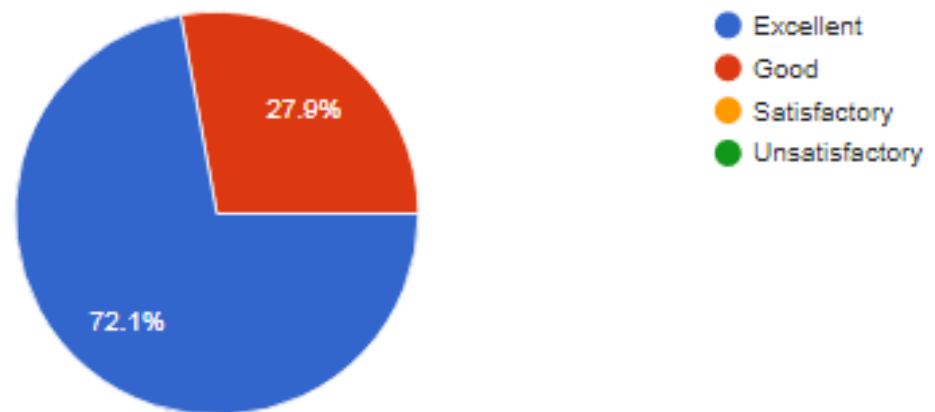
How were the assignments qualitatively

61 responses



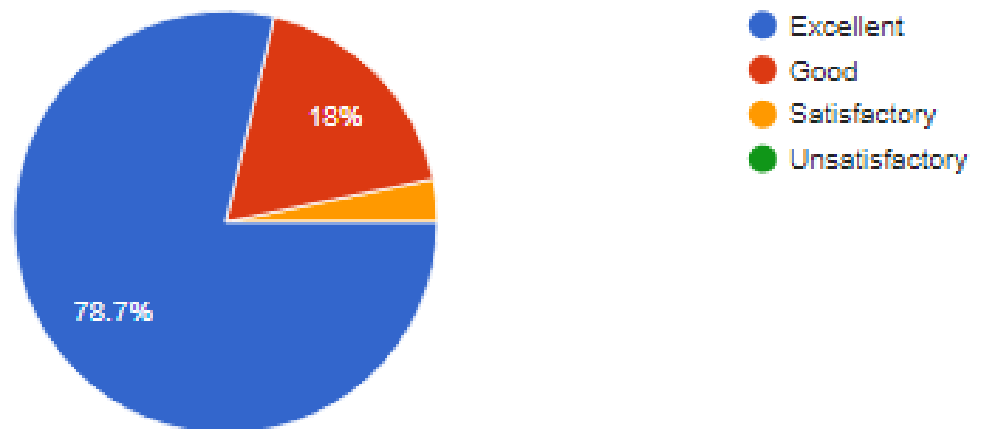
### Rate the assignments with respect to the syllabus content?

61 responses



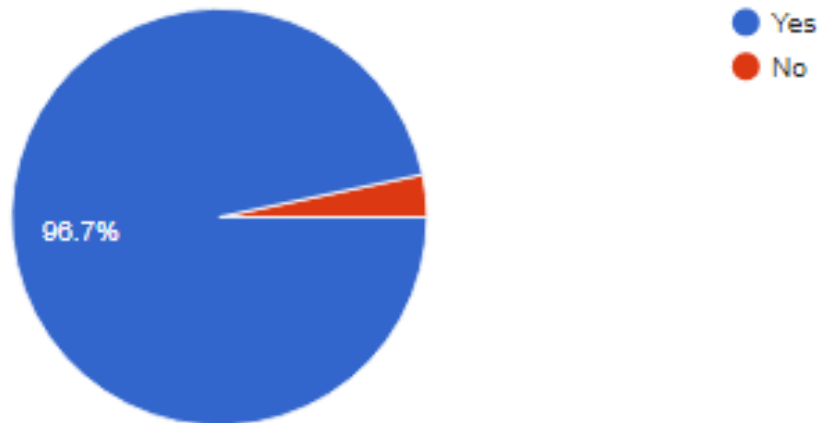
### How were the guidelines for completion of the assignments?

61 responses



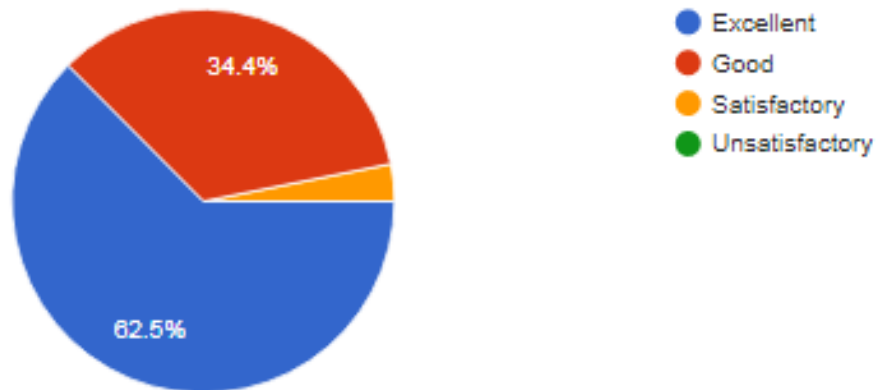
### Was sufficient time given for completion of assignments?

61 responses



### Rate the assignments with regards to better understanding of the subject

64 responses



## RESULTS AND DISCUSSION

The assignment based learning greatly helped the students in learning the course of machine design, with following benefits

- i. The teacher can know the understanding level of the students very closely, on weekly basis, which is helpful in planning the content and delivery of the subsequent lectures appropriately.
- ii. Project based assignment greatly enhances the critical thinking and analytical ability
- iii. Project based assignment enriches the project report writing and drawing skills.
- iv. Project based assignment and Presentation based assignment improves the team work and corroborative learning skills.
- v. Presentation based assignment demonstrates the presentation skills
- vi. Working with small groups of students ensures better mentoring and individual attention.

## CONCLUSION

Assignment based learning is an effective and beneficial pedagogical practice which not only ensures better teaching-learning process but also enhances the critical thinking, problem solving ability and technical communication skills of students. This technique is more suitable for analytical courses and more effective for senior classes.

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## COLLABORATIVE LEARNING AS EFFECTIVE ACTIVE LEARNING TOOL: AN OVERVIEW AND A CASE STUDY

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### ABSTRACT

Collaborative learning is used as an umbrella term for a variety of approaches in education that involve joint intellectual effort by students and teachers by engaging individuals in interdependent learning activities. In this article cognizance of different theories of collaborative learning and findings of many researcher have taken into account which was found beneficial in helping students learn effectively and efficiently than if they were to learn on their own. A case study in the article is the first step to adopt this effective learning tool to develop higher thinking skills in students in higher education. Collaborative learning as active learning tool show some positive results in students as they are able to learn more by discussing with one another and making sure everyone understands. More retention of information through thoughtful discussion, and development of positive attitude about learning and interpersonal skills by working together and developing favourable attitude for learning and improvement of interpersonal skills by working together are important positive things that developed in students when involved in collaborative learning. Thus, encouraging collaborative learning may help in improving the learning environment in higher education.

### INTRODUCTION

Collaborative learning is the educational approach which involves groups of students working together in order to enhance learning. This approach, rather than using rote memorization of facts and figures actively engages students to process and synthesize information and concepts. Students work with each other on given problem or projects, where they collaborate as a group to understand the concepts involved in given problem or project given to them. Through this approach students learn to defend their positions, reframe their ideas, listen to others viewpoints and articulate their points, in this way they gain a complete understanding as a group than they could as individuals. Collaborative Learning is among the modern approaches in learning. There are some important benefits of collaborative learning approach w.r.t. students such as it turns learning into a truly active process, promotes learning from others viewpoints, it teaches how to think critically and quickly, promotes listening to criticism and advice, develops public speaking and active listening skills and improves cooperation.

There are three collaborative learning theories namely, Vygotsky's theory of social development, Piaget's theory of cognitive development and Kegan's cognitive developmental theory. There are some differences between these three collaborative learning theories. Collaborative learning is based on the concept that learning is naturally a social act and it occurs through talking, attempting to solve problems and trying to understand the world. Both Piaget and Vygotsky differed on some key point but have agreement on that cognitive development comes in stages and has roots in both nature and nurture. The main difference is that Piaget thought that the result of cognitive development was language, Vygotsky thought that language was the key to cognitive development. Vygotsky's highlighted the importance of learning through communication and interactions with others rather than just through independent work. In today's scenario this idea of group learning for teaching some new concept is being used in collaborative learning.

Collaborative learning is very important active learning tool in achieving critical thinking. According to Gokhale (1995), when individuals work in a group rather than alone, they attain higher levels of learning and retain more information. This not only enhances the knowledge of individual learner but also of the facilitator- instructor.

## LITERATURE REVIEW

Many researchers involved in collaborative learning studied the process of teaching-learning and mentioned different aspects which make this approach an effective tool of learning.

The learning opportunity in collaborative learning can give room for students to think critically and their ideas can be evaluated by all members in the group. Students become critical thinkers since they take responsibility for their own learning when discussions are conducted in the class (Gokhale, 1995 in Totten, Sills, Digby, & Russ, 1991).

Collaborative learning is the umbrella term where 'a joint-venture' of teaching-learning experience is depicted in class. In this environment, students and teachers benefit from the discussion in searching for mutual understanding, solution or meanings, or creating a product (Smith & MacGregor, 1992). Implementations of collaborative learning used in classes can be in the writing group, peer teaching and problem-structured instruction (Smith & MacGregor, 1992).

Volery & Lord (2000), support the argument by saying that teachers' roles are crucial in effective collaborative learning. They serve as the catalyst by having students to be the manager of their learning experiences. In their study of online education among graduate students taking business course, they found out that "the level of interaction between the students and the lecturer appears *predominant* in online delivery" (Volery & Lord, 2000, p. 222).

In a study by Gokhale's (1995), 48 undergraduate students in his study value mistakes and partially flawed opinions make by their fellow friends. This is because the collaborative learning enables the students to have their opinion after critically thinking as they have to give reason for their own opinion. There are many ways to make collaborative learning very effective learning tool to all students involved in it. Ingram & Hathorn (2004), suggest that by using this active learning tool, a meaningful goal can be stated and accordingly instructions can be given to the group to collaborate in order to reach the goal.

Buckelew (1999), suggests that teachers need to play their parts in the learning process. She states that collaborative learning allows peer groups to act as teachers while the teacher her/ himself works as a director or coach.

A study conducted by Keith & Angela (2004), on peer tutoring of reading and thinking reveals that students enjoy the social aspect of the activity (peer tutoring of reading and thinking) where they have the chance to collaborate (pairing with other students) with one another in exchanging their thoughts, feelings and etc. Consequently, students in the study having a wide range of abilities are able to develop reading comprehension skills into higher-level thinking skills. The study also state that the activity, "went beyond the author's intended meaning, went beyond the book read among others" (Keith & Angela, 2004). Teachers who are tutors in the study assert that they have to judge what questions to ask and when to ask them, to explain or give answers when necessary, and to give appropriate thinking time to the students (Keith & Angela, 2004) in respect to obtaining higher level thinking skills among students.

Learners (adult) should be exposed to dialogue and questioning (of analysis, synthesis and evaluation) to reflect higher order thinking skills as stated in the literature of a handbook produced by Ohio State Department of Education. Unfortunately, the handbook reveals that many teachers in adult learning classroom expose students to questions that contain lower level thinking skills which are of knowledge and comprehension (Gall, 1994).

## COLLABORATIVE LEARNING APPROACHES

Collaborative learning includes variety of approaches. It can range from short classroom discussions to research team that last a whole term or year. The objective of collaborative learning can also vary from solving class assignment to developing some product.

**Co Operative learning:** It is the most structured form of collaborative learning. Defined as "the instructional use of small groups so that students work together to maximize their own and each other's learning" (Johnson et al. 1990). It helps in developing interpersonal and social skills along with learning. It involves assigning roles within each small group. Students are actively involved in the given task. Teachers are not directly "teaching" when cooperative learning occurs. Instead, they are ensuring groups of students stay on task.

**Problem-Centered Instruction:** Guided Design, cases, and simulations are all forms of problem-centered instruction, which immerse students in complex problems that they must analyze and work through together. (Barbara Leigh Smith and Jean T. MacGregor). In guided design students work in small groups and perform sequenced tasks. They receive detailed feedback at every step. case study involves some real-life situation as a problem statement that students must analyze and work through together. Simulations are complex, structured role-playing situations that simulate real experiences. After simulation, usually a discussion session is conducted where students share their experience on the simulation and explore their own actions and of others.

**Writing Groups:** In writing groups approach students work in small groups at every step of writing process. They exchange their written drafts of paper and get feedback

**Think pair share:** Think-pair-share (TPS) is a collaborative learning approach where students work together to find solution of a given problem. In this approach students need to (1) think independently about the problem and (2) share views with classmates. Discussing with a partner helps to maximize participation, to focus attention

**Jigsaw:** The jigsaw classroom is a research-based cooperative learning technique invented and developed in the early 1970s by Elliot Aronson and his students at the University of Texas and the University of California. Like a jigsaw puzzle, role of each student is essential to fully understand and complete the final product. In this method teacher break students into groups and assign smaller tasks. This help students to accomplish tasks with more

detail and collaboration. To obtain the final result the contribution of each student is needed. This inculcate positive interdependence. The jigsaw method develops a sense of ownership among students and emphasises importance of team work.

Peer Review: In this approach students review each other's work. It is a great way to make sure each student benefits from individual feedback and attention, even in a large group.

## METHODOLOGY

Designing collaborative learning tasks is an education in itself. The benefits of collaborative learning discussed above by researchers and practitioners cannot be achieved just by putting some students together to work in a group. On the other hand, the teacher has to put efforts on the format, script and the end result that student should achieve on the completion of the experiments.

- **Case Study:**

First Year B.Tech students perform some chemistry experiments using collaborative learning approaches. Students perform in pair or in group of three.

Among all experiments conducted in chemistry lab for two experiments collaborative learning approach was used. These two experiments were on water technology namely, alkalinity determination and EDTA method for hardness determination. The approach for the same is discussed here. Students were provided with the sheet, containing basic information of the experiment which include the theory and with fewer guidelines, the objective(s) of the experiment was stated. For the given experiment, student group had to understand the theory and accordingly formulate the steps for the performance (procedure). For constructing the steps for the experiments students discuss within their group and also refer to resources available like reference books, internet and then confirm it with the instructor. After the approval of instructor they perform the experiment in the group and record observations and then based on observations they do calculation of the property to be determined. Based on values of quantity they get, in the group they discuss and write the conclusion.

In two hours students have to perform the experiment to fulfil the objective(s) and deduce results and conclusions. In these two experiments, the end goal is to determine specific property of water sample given to the group. To help students to reach their goal in their journey of two hours, a lab instructor plays the role of mentor.

Over the conventional laboratory experiment conduction, the implementation of collaborative learning for some chemistry experiments in the lab has following benefits.

1. As earlier stated the experiment sheets are designed for the collaborative experiment performance. There are various stages during experiment performance which facilitate interactions and discussions among the students to reach the end goal. Each student contributes their chemistry knowledge. Laboratory instructor keeps an eye on their progress and acts as a mentor. He/she makes objectives clear, then be available, listen, facilitate, answer questions when needed, provide directions when extremely needed and encourage participation of each student in the group. Students are also encouraged to refer to books and the internet for advanced learning. Positive interdependence is observed in the student group.

2. In this two hour lab performance student develops social skills, or team-working skills, including effective communication, interpersonal, cognitive skills and time management skill. Further they develop deeper understanding of experiment by comparing and analysing results and discussing and arriving at common grounds for conclusions leads to trust building and decision making skills in students of the group. The interactions, discussions, processing and performance in group help them to retain their learning for life time. This helps them to work more effectively in the future as a group.

3. Students in the group who identify the end goal, while performing the experiments periodically assess what they are doing by themselves and by the mentor as well. Whenever needed the student group process and make changes in performance tasks during their lab performance. The interactions, discussions, processing and performance help them to retain their learning for life time. This helps them to work more effectively in the future as a group.

4. Even though the students are working in groups to achieve the end goal, they are well aware that individual effort of each student is observed and evaluated. All members in a group are held accountable for doing their share while performing the experiment and for mastery of all of the material to be learned.

## RESULT AND CONCLUSION

In collaborative learning socio-cognitive collaboration is required which must be taught to students. The teacher is responsible for the students' learning to collaborate efficiently among them, transforming the class into a teaching-learning community. For this, faculty should be available with wide spectrum of strategies that can be implemented in different instances, according to the different types of tasks (Roselli, 2011).

In the case study it was witnessed that students were quite active and were able to demonstrate both, collaborative learning and higher order thinking skills when they were put into a group.

It is observed that collaborative learning could assist and enhance overall learning experience through positive interdependence.

Hence, we can conclude that in collaborative learning sharing of ideas, thoughts and opinion occurs which help the student to understand and analyse the problem given at the same time evaluation becomes much easier in group rather than alone.

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## EFFECTIVE USE OF SCREENCASTING FOR ENHANCING STUDENT CENTRIC LEARNING USING AN ACTIVEPRESENTER TOOL

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### ABSTRACT

Three important pillars of outcome based education (OBE) are student-centric curriculum, instructional methods and assessment. Faculty are the facilitators and are the designers of instruction methods to foster active learning amongst the students in higher education. There exists plentiful of advanced pedagogical tools and techniques to fulfill aims and objectives of OBE for empowering student-centric learning. This paper presents an overview of one of such pedagogical tools, screencasting softwares, that can be used very effectively to enhance students' learning by gauging their competencies. Screencasting is a digital audio-video recording of the presenter's screen. Such a recording can be created with a thoughtful planning that leads to information-rich multimedia presentations. This recording can be provided to the students through flipped classroom or blended learning modalities that essentially will help assessing the students' based on cognitive levels in revised bloom's technology. Thus recording educational videos is the preliminary step to implement many such pedagogical techniques in teaching-learning process. A case study on ActivePresenter gives detailed idea from the lecture planning to entire recording process.

### INTRODUCTION

As the world move to the online education, due to pandemic situation all around, entire teaching fraternity from school level to higher education have adopted both synchronous and asynchronous modes for teaching the students. In both of the modes there are reasonable number of choices available for the teachers to record the audio and video course contents. Prerecorded lecture videos are the screencasts that can be designed effectively to augment real-time synchronous mode of teaching. It is a powerful tool which can be used to keep pace with the learning quotient/cognitive levels of the students. Screencasts facilitate learners to synchronize their learning process at their own pace.

With the information era, there has been tremendous rise in the online resources available to the learners in every kind of subject. Typically, in the engineering field there are many standardized Massive Open Online Course (MOOC) platforms like National Programme on Technology Enhanced Learning (NPTEL), Coursera and others in their well-organized asynchronous yet online contents useful for learning and self-assessment. Today's generation of students' is more inclined to take up this form education rather than traditional instructional methods. Therefore, it has become essential to learn to create teaching resources to facilitate their learning inline to such kind of standard MOOC resources, which is possible when we use technology like screencasting. In engineering education, it is found to be extremely useful for both theory and laboratory courses including programming assignments.

Prensky M. [1], termed to the people born before 1980 (digital era beginning) as digital immigrants and digital natives to those who were born during or after that. So we can say that teachers are the digital immigrants and students are digital natives. And therefore enhancing teaching practices by using an effective technology like screencasting will make learning more engaging for the digital natives.

### RELATED WORK

Screencasting term was first coined by J. Udell [2] in 2004. Screencasts are video recordings of a narration given by a presenter along with the interactive on-screen activities such as software demonstration or teaching using the digital pen and tablets. Screencasting tools allow to record what is there on screen such as PowerPoint presentation, drawing, writing, programming with audio effects. Use of screencasting for higher education has been reported widely in the literature.

Jesus and Moreira in [3] carried out study to assess the effect of using screencasts on undergraduate students' understanding and their engagement with learning material while giving example of one of their modules. They also discussed the reasons why students choose to engage or not with these resources. Loch and McLoughlin [4] presented an overview of instructional design approaches using screencasts as a self-regulated learning models in understanding complex mathematical concepts.

Pinder-Grover et. al[5], have documented the strategic use of screencasts for Materials Science and Engineering (MSE) course, and studied their impact on student usage and course performance. Green et al. [6] suggested about screencasting technology that it is well perceived by students it helped improving course performance.

In [7], authors assessed the effect of screencast tutorials on learning outcomes including statistical knowledge, application, and interpretation. In support that, their study proves effectiveness of the use of computer-assisted technology in teaching statistics to undergraduate psychology students. Powell and Wimmer [8] conducted a study for undergraduate business students at a university in Pennsylvania State System of Higher Education system for over four semesters. In this study they evaluated effectiveness of self-created screencasts as a tool to increase learning outcomes of students for programming course. Kilickaya F. [9] has given a review of studies within two streams of research on the use of screencasting for both delivering lectures and giving feedback and has suggested some important pedagogical implications. Roslinda et al. [10] discussed innovative use of the screencasting technique in education especially in learning 3D animation software, which is more engaging than conventional textbook teaching of the same.

## OVERVIEW OF SCREENRECORDING SOFTWARES

In this section, a brief overview of existing screencasting/ screenrecording softwares is provided. There exists variety of screencasting tools suitable to record the audio-video of the presenter while capturing the screen recording area. Fig. 1 shows some of the popularly known tools. A detailed summary on wide range of screencasting tools along with their utility features, platform and other technical support are available at [11].

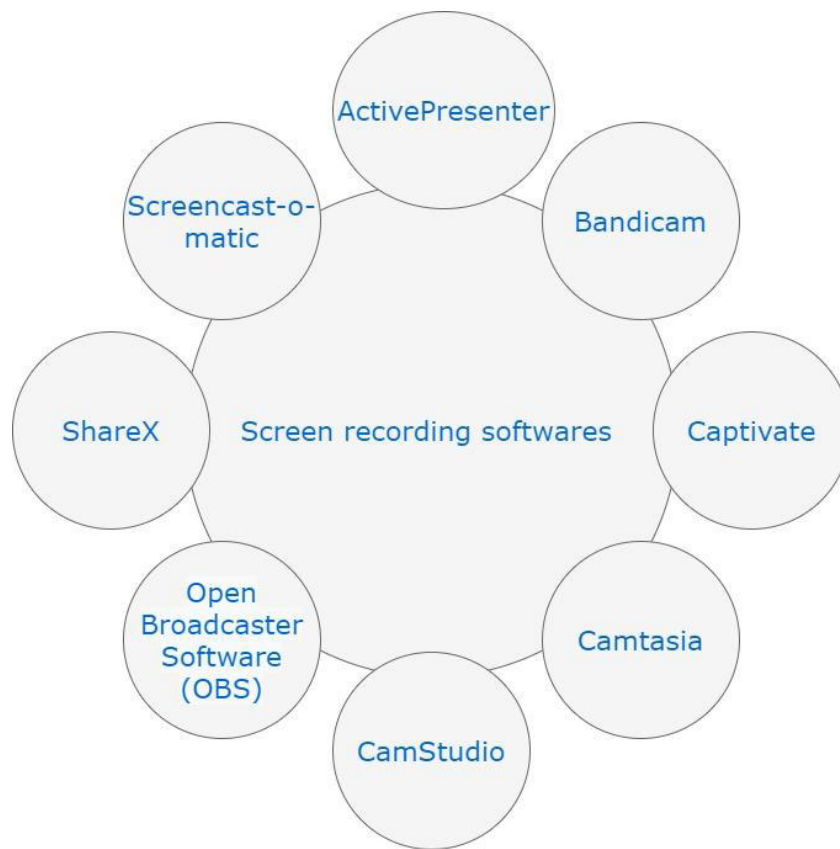


Fig 1: Some useful screenrecording tools

These software tools are available either as a free or paid version. Usually the free or trial versions have limited recording time and are not useful for recording large videos (e.g. a free version of Screencast-O-matic have a recording time limit of 15 minutes). Many free tools add in the recorded videos their watermark. Some of the tools offer limited features in their free

version, so the interactive contents may not be added in the created videos. Table 1 summarizes the features of some screencasting software tools [12].

Taking into account all these aspects, in this paper a screencasting tool is selected as ActivePresenter, which is available both as a free edition and paid version. Even in the free edition of ActivePresenter all the necessary video editing and interactive video creation utilities are supported without any recording time limit. It doesn't add any watermark and allow users to select recording area easily. Once the recording is stopped it gives multiple choices to convert the recording into desirable video format and can also be directly uploaded to YouTube. A comprehensive tutorial series is available at Atomisystems website [13] to explore more utilities in ActivePresenter. A short YouTube video created and published) on the step-by-step procedure for- How to prepare educational videos using screen-casting software- Active Presenter, is available in [14]. This short video is an example of how the recorded video by ActivePresenter appears on YouTube if published, once it is published.

**Table 1: Screencasting tools - A comparative summary of features**

	Screencasting Tools				
	ActivePresenter	Camtasia	CamStudio	Open Broadcaster Software (OBS)	Screencast-O-matic
<b>Websites</b>	<a href="https://atomisystems.com/activepresenter/">https://atomisystems.com/activepresenter/</a>	<a href="https://www.techsmith.com/video-editor.html">https://www.techsmith.com/video-editor.html</a>	<a href="https://camstudio.org/">https://camstudio.org/</a>	<a href="https://obsproject.com/">https://obsproject.com/</a>	<a href="https://screencast-o-matic.com/">https://screencast-o-matic.com/</a>
<b>Platforms</b>	Windows and Mac	Windows and Mac	Windows and Linux	Windows, Mac, Linux	Windows, Mac, Chromebook
<b>Nature of tools- Price and other features</b>	Free Edition and Paid	30 days Trial version and Paid	Free version	Free version	15-minutes time limit per recording in Free version; Watermark added to videos; Monthly subscriptions in paid version
<b>Recommended applications</b>	All-in-One Screen Recorder, Video Editor, eLearning Authoring Software	Presentation recordings, Interactive quizzes	Tutorial making, Streaming	Gaming, Streaming, Instructional videos, Screencasting	Presentations, Tutorials, Screencasting

## METHODOLOGY- RECORDING WITH ACTIVEPRESENTER

The latest version of ActivePresenter can be downloaded easily from the website- <https://atomisystems.com/activepresenter/>. The downloaded executable file is to be selected based on the type of operating system on the computer. After the installation a new project can be created as given in the steps below:

- 1) Select the template (similar to the PowerPoint presentation) and save it as a project.
- 2) Start recording a video by clicking 'Record a video'.

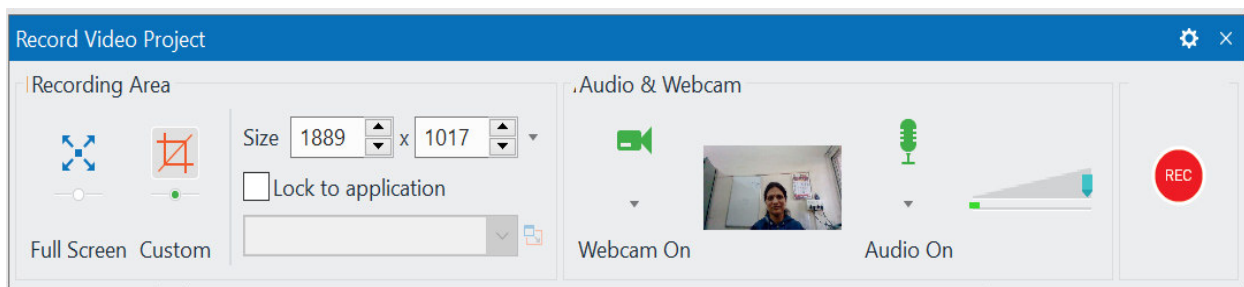
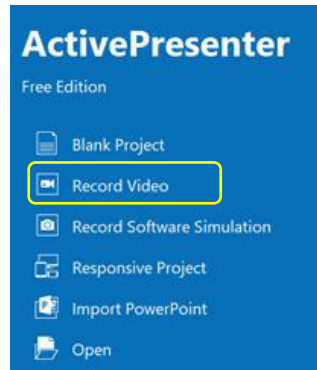


Fig 2: Start video recording

3) Additional features can be added in the video project to make the video more interactive with the inclusion of interaction questionnaires such as True/False, Multiple choice, Multiple responses, Drag-n-Drop etc.

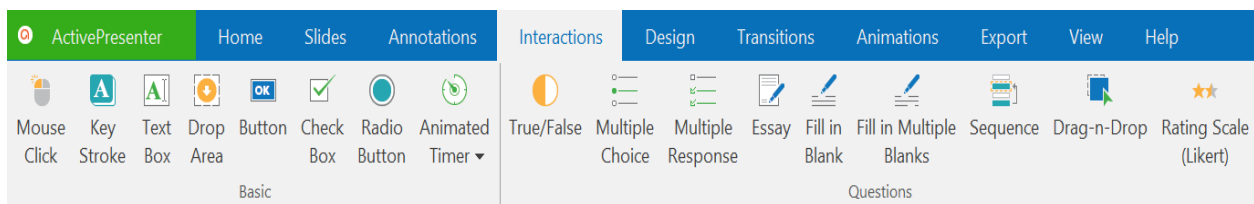
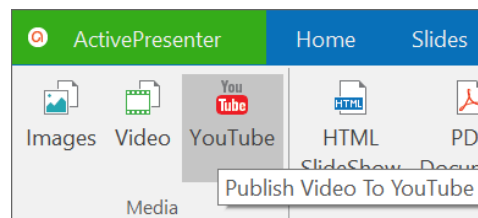


Fig 3: Adding interactive features

4) Stop the recording and export project to video file or publish to YouTube.



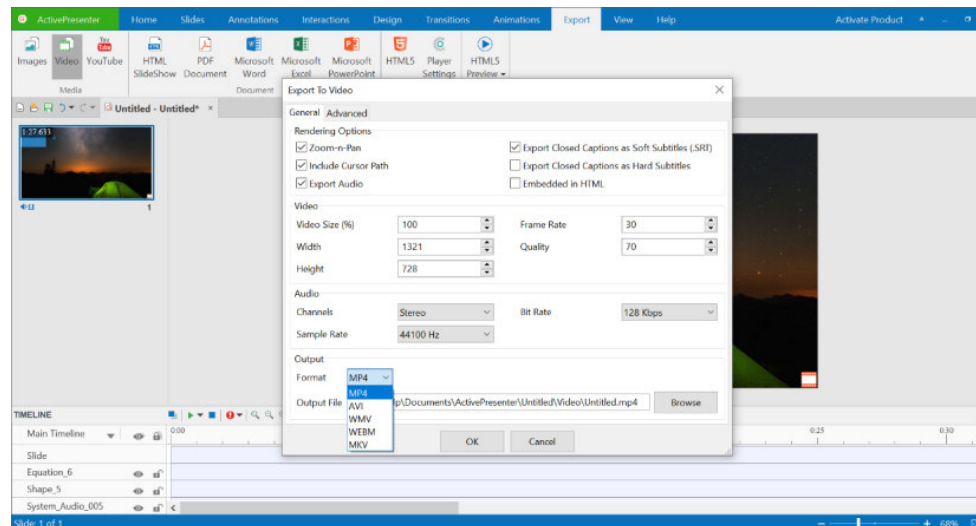


Fig 4: Export video to different video formats

## CONCLUSIONS

Screencasting is one of the very powerful technology-enabled instructional tool. Creating educational videos using this technology is quite useful to enhance students' learning outcomes. ActivePresenter is one of such tools that can be used to the fullest to create interactive e-learning contents. In this paper significance of screencasting is outlined with the detailing of steps to record multimedia presentations using ActivePresenter. Adding the interactivity in the form of creating responsive projects and post video editing facilities available in this tools makes it as one the suitable choices to design course contents inline to OBE needs. Recorded videos can be used in the form of MOOCs or in the pedagogical techniques such as flipped classroom or blended teaching-learning. Additionally, such tools can also be recommended to students for making effective presentation recordings and faculty can use it for their assessment.

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[13] <https://atomisystems.com/tutorials/ap8/activepresenter-8-a-comprehensive-guide-for-beginners/>

[14] [https://www.youtube.com/watch?v=\\_d3CgpIE-m0](https://www.youtube.com/watch?v=_d3CgpIE-m0) (How to prepare educational videos using screen-casting software- Active Presenter)

## OVERVIEW OF E-CONTENT DEVELOPMENT USING ANDROID APP

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### ABSTRACT

Information technology and the Internet are major drivers of research, innovation, growth and social change. The growth of the Internet has brought changes in all walks of life including education. E-content requires huge amounts of creativity both at the 'information' level as well as the 'technology' level. In COVID19 outbreak smartphones become an essential tool for teachers as well as students to enrich their learning. In this document, we have compiled a list of the most useful educational apps that you can use on your Android phone to provide a better learning experience to your students which also simplifies your everyday teaching tasks.

### INTRODUCTION

In this document we explained essential steps for eContent development, types of eLearning videos, Android apps for video making and editing and at the end we discussed why teachers and students should use video as an eLearning tool.

### E-CONTENT DEVELOPMENT PROCESS

Followings are the Seven Common eContent Development steps:

1. **Analysis:** Analysis is the first step of the eLearning development process. In this stage the learning content, audience (targeting people) , and the objectives of learning are analyzed . By using the proper instructional method the contents are presented.
2. **Creating The Instructional Design Document (IDD) :** An IDD specifies the instructional design approach, learning Objects like images, animations, videos, examples and key takeaway etc. IDD covers all aspects, from a detailed outline to the screen level treatment.
3. **Scripting:** In this stage, the content to be used for each topic, its subtopics are finalized and divided into modules. Then, the details about each screen is decided. Most of the time a word document or a PowerPoint presentation is used for scripting.
4. **Prototype Development:** Once the script is ready a typical prototype decides the screen contents, screen background and final audio treatment. Prototypes help focus on animations, interactive to be applied, colors, images and browser compatibility.
5. **Developing The Course Without Including Audio:** Once the Prototype is approved, the contents are sent to team members/Stakeholders for approval. Once the contents are approved, the audio script is prepared.
6. **Developing The Course With Audio:** Once the audio script is final, the audio file is created. While creating the audio, one should take care of the quality of the audio, pronunciation and the synchronization of the audio with the on screen text/images/animation etc.
7. **Creating The Learning Management System Version:** This is the last and final important step in making the eContents compatible with different browsers. Once the browser-related issues and other technical glitches are sorted out. Finally the eContent uploaded for learners.

## HOW TO CREATE E-LEARNING VIDEOS

Here are 3 easy methods to create eLearning videos

1. **Live Lecture Videos** : For many teachers, flipping the classroom begins with live recording their lectures. Sending recorded lectures to students allows them to pause and rewatch if they didn't understand it the first time. With recorded lectures, students will be able to pause the video, rewatch the lesson multiple times according to their learning pace and needs. You don't have to record teaching videos inside the classroom alone. You can record your lectures and share them with your students anytime and from anywhere.
2. **Screen Recording Videos** : A lot of teachers tried recording their screen in an attempt to lecture. It's an entirely popular means of creating videos among teachers around the world. Screen recording lets you record everything with/without audio that appears on your screen. It allows you to create mini-lectures by narrating over the screen. Recording your screen is a piece of cake now with the advent of browser-based video tools. With such tools, you will be able to create professional screen recordings and share them with your students instantly. Screen recording videos are created especially for hard-to-grasp concepts so students can view them multiple times. It saves you valuable class time and helps engage your students in the classroom, so look for a screencasting tool with some editing capabilities.
  - Screencast-O-Matic
  - Active Presenter
  - Allconnect – Play & Stream
  - Livescreen – Screen Mirror
3. **Video Presentations** : As you explore better ways to increase the engagement rate between students and teachers, recording video presentations can be a good choice.

## ANDROID APPS FOR VIDEO MAKING

Here are Android apps are for creating and editing videos on the go. They provide a wide variety of features that enable you to design stunning clips without the need to have prior graphics or video editing knowledge. Some of these features include: the ability to trim or cut out unwanted scenes from your videos, add audio clips and music to your videos, use voice overs (some apps let you record your voice over the video), merge various clips into one, animate clips with different transition and animation styles, resize and adjust the speed of your videos, create slow motion clips, playback videos in reverse and many more. All of these apps are free to install and use.

1. **VivaVideo** : VivaVideo has a lot of impressive video making and editing features. Anyone can create professional looking videos by using this app. To animated clips and subtitles users can choose from hundreds of user-friendly effects that range from stickers and filters. The video editing options such as cut and paste videos, trimming, merging clips, etc. are easy to operate.
2. **Kinemaster** : KineMaster is a convenient video editing and with a well-designed interface along with powerful features for Android. By using this app users have great control over the editing process to create professional videos quickly. Users can add different types of transition in between video fragments, or insert blocks of texts or subtitles, and import different media files easily using the drag-n-drop technique.
3. **PowerDirector** : PowerDirector is a fully featured android video editor that has an easy-to-use timeline interface. This App provides tutorial videos for all of its functions. The unique feature of this app is that users can create awesome green (Chroma) screen videos. Using this app users can add over 30 different effects and transition effects to choose from and add to the video.
4. **Ntrack**: N-Track Studio is a powerful, portable music-making app. The built-in mic or any class-compliant USB audio device (requires compatible Android & USB devices) supports Recording. This app allows Record Audio, MIDI tracks using the built-in screen keyboard or an external USB MIDI keyboard & MIDI instruments on the move and export as WAVs - or use .sng format to load sessions on n-Track Studio for Windows & Mac to finalise mixes.
5. **Cinema FV5 Lite** : This is a camera app for recording good quality videos on your Android smartphone. Cinema FV-5 Lite helps a user to record videos with controlling different camera features. Cinema FV-5 specially supports Android-based compact cameras, so you can even leverage a high-quality, optically stabilized zoom. The footage captured with Cinema FV-5 can be easily edited on any NLE like Apple Final Cut Pro, Adobe Premiere, Sony Vegas or DaVinci Resolve.



6. Animoto Video Maker : Creating videos has been made quite simple and effortless in the Animoto Video Maker app. The app enables you to not only educational videos and clips but also to share them with your students through mail, Twitter and Facebook. You can use the images stored in your device's gallery in your video clips and even add songs and captions to them.

Following table summarizes special features of these Apps

Table 1 : Special Features of video making Apps

Sr. No.	App	Special Features
1	VivaVideo	Built-in slow motion video editor. A wide variety of collage templates and themes to choose from. Video collage maker for merging video clips.
2	Kinemaster	Multiple layers of videos, images, text, effects, overlays, stickers, and handwriting can be combined. Instant preview feature for viewing the editing. Precise volume control from moment to moment within a clip.
3	PowerDirector	Action camera tools, Full feature editor and True theater color. Magic movie wizard and Motion tracking. Encoding and exporting and 360-degree footage tools.
4	Ntrack	192kHz 24-bit high-definition (HD DVD, Blu-ray, etc.) audio recording. Extensive plug-in support, and DVD-Video surround mixing up to 7.1 channel. Support real time effects. Pro-audio recording quality.
5	Cinema FV5 Lite	Zoom after and while recording. Focus adjustments during recording. Choose video and audio codec. Video geotagging support.
6	Animoto Video Maker	You can add your logo as a watermark. Three Aspect Ratios. Brand Colours.

## ANDROID APPS FOR VIDEO EDITING

Following are the few Android Apps for Video Editing.

1. AndroVid Video Editor : AndroVid Video Editor video special effects app will allow users to apply any type of video effect which the user wants once downloaded and installed to the computer. Some of these effects include fade in and out, slow and fast motion, mirror and gray tone. After that, upload the videos easily to online sites and share with friends. With this app editing is fully professional because of the many features and functionalities it offers.
2. Andromedia Video Editor : The layout of this video app is one of the easiest to use and will give users an easy time when applying effects. This app gives a user friendly interface. This app supports a wide variety of file formats including MOV, MP4, WAV and MP3. Its biggest advantage is easy editing courtesy of the intuitive interface.
3. VIDTRIM : VIDTRIM app supports different languages including English, German and Italian. Its cool effects include vintage, negate, blur, edge detect and sharpen. It is simply the best option for enhancing your video. This app offers complete video compression and easy sharing of edited video.
4. VIDEOSHOW : VIDEOSHOW is both a video editor and maker that works at extremely high speeds. It has some beautiful effects that users can apply to video including sketch, sepia and beauty. Due to a user-friendly interface it's easy to add texts while editing. Users enjoy free and easy editing on top of easy video sharing. All formats are not supported by this app.
5. YouCut : YouCut is a popular free video editing app on Android and it does not feature a watermark on videos. Further, the app is brimming with top video editing features and does not serve ads which makes it a perfect pick for our use-case.

## CONCLUSION

Using videos in the classroom reaches students with a variety of learning styles like visual, aural, physical or verbal. It motivates and engages students by allowing them to learn at their own pace. Video allows teachers to save hours of repetitive teaching. Students can re-watch videos anytime and anywhere when absent or during exam revision. Videos promote Independent learning. Students learn better when they understand a concept on their own. Students watch video lectures and learn independently. Videos help students 'learn by doing', and because of this, a student's ability to remember a topic improves. It also boosts In-Class Engagement of students. Videos keep the students engaged longer and actively involved throughout the lesson. Engaged students participate more in the class, are less distracted, and retain what they've learned longer than those who weren't participating enough in the class. It also facilitates Peer-Peer Collaboration.

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### Report on awareness/training sessions arranged by College Pedagogy Cell

❖ Pedagogy cell is meeting regularly and studying different pedagogy practices adopted / practiced by different engineering institutes across India and abroad. Objectives and Expected Outcomes in line with Perspective Plan for Context: - Teaching and Learning have been finalized and details are given in following table.

Context :- Teaching and Learning			
Sr. No.	Faculty Teams (Prof.)	Work content	Expected Outcomes
<b>PPC New Pedagogic Practices</b>			
1	<b>Dr. Anand Bewoor</b>	Study of new methodologies and support for implementation of selected methodologies viz. 1. Active learning, 2. Project Based Learning, 3. Flipped Classroom.	<ul style="list-style-type: none"> <li>• Courses which adopted best pedagogic practices</li> <li>• Publication of bulletin, articles/papers etc.</li> </ul>
2	Dr. Vaishali Upadhye		
3	Dr. Shubhangi Tikhe		
4	Madhura Tokekar		
5	Dr. Manisha Jail		
6	Mrunal Moharir		
<b>OERC Online Educational Resources</b>			
8	Dr. Ashwini Deshpande	Study of... 1. Tools for Creation of Digital Content, 2. Support for selection of Tools for creation of Digital Content, 3. Development of MOOCs.	<ul style="list-style-type: none"> <li>• Courses with creation of digital content.</li> <li>• NPTEL- MOOC Courses offered as blended mode with regular course.</li> <li>• Development of 'Course level Moodle'.</li> </ul>
9	Dr. Sharada N. Ohatkar		
10	Dr. Chhaya Gosavi		
11	Mahendra Deore		
12	N. R. Patil		
<ul style="list-style-type: none"> <li>• <b>PSC</b> = Committee for Pedagogy Study and Support,</li> <li>• <b>OERC</b> = Committee for support to develop Online Educational Resources.</li> </ul>			

❖ In the academic year 2019-20, following activities were arranged for college faculties.

#### I: Event (4<sup>th</sup> August 2018): Expert lecture on Implementation of Project Based Learning

Disseminations of learning of these tools and techniques have been done through awareness / training program not only by Pedagogy Cell members but also by domain experts [e.g. **Dr. Vikas Shinde** [well known PBL Trainer] has delivered one session on "**Implementation of Project Based Learning**".



Dr. Vikas Shinde delivering session on Implementation of Project Based Learning

**II: Event (4<sup>th</sup> Jan 2020): Session by Pedagogy Cell for all CCEW faculty**

- i. **Dr. Sharada Ohatkar** demonstrated the '**Use of Google-forms**' for creating a quiz. She had used such quiz for her course evaluation. She showed the analysis of answers given by the students for a generated quiz as graphs. She explained how to interpret such graphs. Then she showed settings for the quiz in general. In particular, she showed how to set those students should attempt the quiz only once or '*time bar for the examination*' etc. to all the members. A further, different feature of **Google classroom** was also explained with a case study.  
  
**Dr. Sharada Ohatkar**, illuminated the pedagogical approach called '**Flipped Classroom**'. She explained What is the meaning of Flipped learning in 'Flipped classroom' teaching technique. She also stated reasons to why you should flip your classroom. She then explained the six steps to be followed to implement a flipped classroom. The pedagogical tool '**Crossword**' was demonstrated with help of a case study. How the crossword can be generated with help of <https://www.theteacherscorner.net/> site was explained. The crossword Question sheet and Crossword answer sheet was displayed.
- ii. **Dr. Ashwini Deshpande** had demonstrated the screen capture tool '**Active Presenter**'. She recorded certain screen movements and replayed the clip as a demonstration for all faculty. Dr. Sharada Ohatkar and Dr. Ashwini Deshpande had developed and shared detail stepwise information video about creating a '**Google-forms**' using screen capture tool '**Active Presenter**' with all college faculty.
- iii. **Dr. Anand Bewoor** had presented the concept and procedure of '**Think Pair Share**' activity (**T-P-S**). He had discussed a case study explaining his experience about the T-P-S process adopted for 'TY Mech course: Metrology & Quality Control' and shared the questionnaire to get the feedback from students.
- iv. **Dr. Chhaya Gosavi** had explained the use of '**Online (Open Source) Softwares and Android Applications**' to develop educational videos. She had demonstrated different useful features for developing effective videos.



**Principal, Dr. Madhuri Khambate** addressing the CCEW faculty



Dr. Anand Bewoor



Dr. Ashwini Deshpande



Dr. Sharada Ohatkar



Dr. Chhaya Gosavi



CCEW faculty attending the session

### III: Event (26<sup>th</sup> June to 3<sup>rd</sup> July 2020): One week FDP on Application of Moodle LMS

- v. As we experienced pandemic situation, which has changed education dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. To make online teaching learning activities more effective, published literature was studied and use of open source 'Moodle' as a learning platform was recommend by **College Pedagogy Cell**. '**One week On-line Faculty Development Program on Application of Moodle LMS**' was successfully organized and college faculty could develop and started using their course level Moodle for Teaching and Evaluation purpose. [Separate report of the said FDP is attached next.]

### A report on “Hands-On One Week FDP on: Use of Moodle as LMS”

- ❖ On the background of need to use online platform, CCEW Pedagogy Cell had organized Hands-On One Week FDP on “Use of Moodle as LMS”. Following expected outcomes were defined;

#### Expected Outcomes:

- Learn to operate & exclusive features of Moodle with hands on experience
- Frame student centric CO-PO mapping & attainment in HOTS with help of Moodle, reducing paper work burden on teachers, tracking each student’s progress, with rubrics assessment
- Execute & Promote, 24×7, any time anywhere effective online learning with integrated video conferencing tools like Google meet
- Store, analyze & report students learning data, including attendance tracking in one place, reducing administrative burden on teachers

- For this FDP, **Dr. Vinay Kulkarni** [currently working as, Head, Dept. of Mechanical Engineering, DYPCOE, Akurdi, Pune] and subject matter expert / Moodle trainer along with his team members worked as a trained our faculty.
- The scheduled of this one week online FDP was from 26th June to 3rd July 2020. Every day sessions were started on 10:30am and ended approximately at 12:10pm. Every day sessions were followed by Q & A session. Every Hands-On One Week FDP on “Use of Moodle as LMS” day, Dr. Kulkarni has designed an activity, which helped our department faculty to learn to develop Course-Moodle step by step. The detailed day-wise schedule is as follows,

Day	Details of Training Activities
26 <sup>th</sup> June	1. Moodle Structure, Opening Moodle Account, Self-Registration & Methods of Student’s Enrolment. Registering site in MOODLE, Adding Units of Syllabus
	2. Turn Editing on, Activities and Resources
27 <sup>th</sup> June	3. Various types of Quizzes ( Statistical Report)
	4. Various types of permissions as per role
29 <sup>th</sup> June	5. Assignment Plug-in (Theory Examination)
	6. Assignment Plug-in (Rubrics Examination)
30 <sup>th</sup> June	7. Completion Progress and Course Completion Status
	8. Tracking Students as per NAAC. Moodle at its best
1 <sup>st</sup> July	9. Game Pedagogy
	10. Awarding Badges to students
2 <sup>nd</sup> July	11. Setting Certificate
	12. Analytics Reports from Moodle – Number of Active Students, Grade Charts
3 <sup>rd</sup> July	13. Analytics Reports from Moodle – Hits Distribution, Assignment Submissions
	14. Query, Interaction with Participants, Valedictory

- ❖ It is observed that, all CCEW, Pune faculty members had participated and total 143 faculty members could successfully developed Moodle for their course to teach in next semester.
- ❖ As a part of assignment completion of Hands-on one week FDP on: Use of Moodle as LMS following Moodle links are developed by faculties of CCEW for students’ learning. This activity was strictly considered as criteria of getting FDP Completion Certificate.

1. By Prof. Dr. Supriya Kelkar - Saturday, 27 June 2020, 10:27 AM <a href="https://cn20smkceew.gnomio.com/">https://cn20smkceew.gnomio.com/</a>	20. By Prof. makarand velankar - Saturday, 27 June 2020, 11:02 AM <a href="https://testccoew.gnomio.com/">https://testccoew.gnomio.com/</a>
2. By Prof. Madhuri Tasgaonkar - Monday, 29 June 2020, 10:36 AM <a href="https://dsc020mptceew.gnomio.com">https://dsc020mptceew.gnomio.com</a>	21. By Prof. Pranjali Deshpande - Saturday, 27 June 2020, 11:02 AM <a href="https://dm20padceew.gnomio.com/">https://dm20padceew.gnomio.com/</a>
3. By Prof. Yashwant Munde - Saturday, 27 June 2020, 10:38 AM <a href="https://cadcam.gnomio.com/">https://cadcam.gnomio.com/</a>	22. By Prof. Amruta Bahulikar - Saturday, 27 June 2020, 11:03 AM <a href="https://in20agbcceew.gnomio.com">https://in20agbcceew.gnomio.com</a>
4. By Prof. Sayali Sapkal - Saturday, 27 June 2020, 10:48 AM <a href="https://ma20sasceew.gnomio.com/my/">https://ma20sasceew.gnomio.com/my/</a>	23. By Prof. Dr. Dipali Ramdasi - Saturday, 27 June 2020, 11:03 AM <a href="https://esd20dsrceew.gnomio.com/">https://esd20dsrceew.gnomio.com/</a>
5. By Prof. Parag Chaware - Saturday, 27 June 2020, 10:49 AM <a href="https://heattransfer.gnomio.com/">https://heattransfer.gnomio.com/</a>	24. By Prof. Pratima Kulkarni - Saturday, 27 June 2020, 11:04 AM <a href="https://in20pkceew.gnomio.com">https://in20pkceew.gnomio.com</a>
6. By Prof. Chhaya Gosavi - Saturday, 27 June 2020, 10:55 AM <a href="https://csgccoew.gnomio.com/">https://csgccoew.gnomio.com/</a>	25. By Prof. Dr Anita Jain - Saturday, 27 June 2020, 11:06 AM <a href="https://probandstatistics.gnomio.com/course/view.php?id=2&amp;notifieditingon=1">https://probandstatistics.gnomio.com/course/view.php?id=2&amp;notifieditingon=1</a>
7. By Prof. Dr. Revati Shiram - Saturday, 27 June 2020, 10:55 AM <a href="https://dt20rvsccceew.gnomio.com/">https://dt20rvsccceew.gnomio.com/</a>	26. By Prof. Mrunal Moharir - Saturday, 27 June 2020, 11:06 AM <a href="https://beeemgmceew.gnomio.com">https://beeemgmceew.gnomio.com</a>
8. By Prof. Sayali Sapkal - Saturday, 27 June 2020, 10:58 AM <a href="https://ma20sasceew.gnomio.com/">https://ma20sasceew.gnomio.com/</a>	27. By Prof. Dr. Mrudul Dixit - Saturday, 27 June 2020, 11:07 AM <a href="https://qc20madceew.gnomio.com/course/view.php?id=2">https://qc20madceew.gnomio.com/course/view.php?id=2</a>
9. By Prof. Dr Shubhangi Vinayak Tikhe - Saturday, 27 June 2020, 10:59 AM <a href="https://daa20svtceew">https://daa20svtceew</a>	28. By Prof. Dr. Vaishali Upadhye - Saturday, 27 June 2020, 11:08 AM <a href="https://csc20vmuceew.gnomio.com/">https://csc20vmuceew.gnomio.com/</a>
10. By Prof. Prajakta Deshpande - Saturday, 27 June 2020, 10:59 AM Prajakta Deshpande <a href="https://prajaktatry1.gnomio.com/">https://prajaktatry1.gnomio.com/</a>	29. By Prof. Dr. Anand Bewoor - Saturday, 27 June 2020, 11:08 AM <a href="https://rdmss20akbcceew.gnomio.com">https://rdmss20akbcceew.gnomio.com</a>
11. By Prof. Prajakta Deshpande - Wednesday, 1 July 2020, 12:19 PM <a href="https://qc20sssceew">https://qc20sssceew</a>	30. By Prof. Suchitra Pakale - Saturday, 27 June 2020, 11:09 AM <a href="https://ds20sspcceew.gnomio.com">https://ds20sspcceew.gnomio.com</a>
12. By Prof. Sneha Singh - Saturday, 27 June 2020, 10:59 AM this is my link for studnets	31. By Prof. Leena Panchal - Saturday, 27 June 2020, 11:22 AM <a href="https://stga20lmpceew.gnomio.com/">https://stga20lmpceew.gnomio.com/</a>
13. By Prof. Swati Madhe - Saturday, 27 June 2020, 11:00 AM <a href="https://bi20spmceew.gnomio.com/">https://bi20spmceew.gnomio.com/</a>	By Prof. Harishchandra Patil - Saturday, 27 June 2020, 11:36 AM <a href="https://harishpatil.gnomio.com/?redirect=0">https://harishpatil.gnomio.com/?redirect=0</a>
14. By Prof. Manasi Pathade - Saturday, 27 June 2020, 11:01 AM <a href="https://mvp2020cceew.gnomio.com/">https://mvp2020cceew.gnomio.com/</a>	32. By Prof. Dr. Prachi Mukherji - Saturday, 27 June 2020, 11:41 AM This is for Management for Engineers course mfe20pmceew.gnomio.com
15. By Prof. Tilottama Barhate - Saturday, 27 June 2020, 11:01 AM tbmoodle.gnomio.com	33. By Prof. Yogini A. Kulkarni - Saturday, 27 June 2020, 11:46 AM <a href="https://yoginiakulkarnicceew.gnomio.com/">https://yoginiakulkarnicceew.gnomio.com/</a>
16. By Prof. Sakshi Mandke - Saturday, 27 June 2020, 11:01 AM <a href="https://qc20ssmceew.gnomio.com/user/index.php?contextid=21&amp;id=2&amp;perpage=20&amp;tifirst=A">https://qc20ssmceew.gnomio.com/user/index.php?contextid=21&amp;id=2&amp;perpage=20&amp;tifirst=A</a>	34. By Prof. Padma Hirave - Saturday, 27 June 2020, 12:09 PM <a href="https://cns20pmhceew.gnomio.com/">https://cns20pmhceew.gnomio.com/</a>
17. By Prof. Tejashree Pawar - Saturday, 27 June 2020, 11:01 AM <a href="https://ds20tvpceew.gnomio.com">https://ds20tvpceew.gnomio.com</a>	35. By Prof. Suraj Chavan - Saturday, 27 June 2020, 12:25 PM <a href="https://fpl20srccceew.gnomio.com">https://fpl20srccceew.gnomio.com</a>
18. By Prof. Radhika Bhagwat - Saturday, 27 June 2020, 11:02 AM <a href="https://ai20rabceew.gnomio.com">https://ai20rabceew.gnomio.com</a>	36. By Prof. Dr Anagha Kulkarni - Saturday, 27 June 2020, 12:27 PM <a href="https://ml20arkceew.gnomio.com">https://ml20arkceew.gnomio.com</a>
19. By Prof. Sushila Shelke - Saturday, 27 June 2020, 11:02 AM <a href="https://dm20sssceew.gnomio.com">https://dm20sssceew.gnomio.com</a>	37. By Prof. Prachi pramod Waghmare - Saturday, 27 June 2020, 12:31 PM

<a href="https://dm20ppwccew.gnomio.com">https://dm20ppwccew.gnomio.com</a>	57. By Prof. Dr. Ashwini Deshpande - Saturday, 27 June 2020, 9:46 PM <a href="https://dsp20amdccew.gnomio.com/">https://dsp20amdccew.gnomio.com/</a>
38. By Prof. Madhuri Tasgaonkar - Saturday, 27 June 2020, 12:43 PM <a href="https://dsc020mptccew.gnomio.com">https://dsc020mptccew.gnomio.com</a>	58. By Prof. Dr. Sharada Ohatkar - Saturday, 27 June 2020, 10:17 PM <a href="https://dc20snoccew.gnomio.com/?redirect=0">https://dc20snoccew.gnomio.com/?redirect=0</a>
39. By Prof. Vaishali Salgar - Saturday, 27 June 2020, 12:48 PM <a href="https://psdl20vmsccew.gnomio.com">https://psdl20vmsccew.gnomio.com</a>	59. By Prof. Dr. Madhuri Purandare - Saturday, 27 June 2020, 11:04 PM <a href="https://map2020ccoew.gnomio.com">https://map2020ccoew.gnomio.com</a>
40. By Prof. Milly Thomas - Saturday, 27 June 2020, 1:04 PM <a href="https://millythomas.gnomio.com/">https://millythomas.gnomio.com/</a>	60. By Prof. Ravikant Suryawanshi - Sunday, 28 June 2020, 7:58 AM <a href="https://ds20rtsccew.gnomio.com/">https://ds20rtsccew.gnomio.com/</a>
41. By Prof. Jyoti Geetesh Prasad - Saturday, 27 June 2020, 1:15 PM <a href="http://jyotiprasad.gnomio.com">http://jyotiprasad.gnomio.com</a>	61. By Prof. Dr. Neeta Maitre - Sunday, 28 June 2020, 9:01 AM <a href="https://ob20npmccew.gnomio.com">https://ob20npmccew.gnomio.com</a> created on 26th June 2020
42. By Prof. Anamika Kumari - Saturday, 27 June 2020, 1:42 PM <a href="https://emt20ankccew.gnomio.com/">https://emt20ankccew.gnomio.com/</a>	62. By Prof. DR RAVINDRA INGLE - Sunday, 28 June 2020, 10:51 AM <a href="https://pemedptd20rbiccew.gnomio.com/">https://pemedptd20rbiccew.gnomio.com/</a>
43. By Prof. Sandhya Potadar - Saturday, 27 June 2020, 2:04 PM <a href="https://etcccew.gnomio.com/">https://etcccew.gnomio.com/</a>	63. By Prof. Dr. Anagha Panditrao By Prof. Dr. Mrs. Anagha Panditrao - Sunday, 28 June 2020, 1:36 PM <a href="https://in20ampccew.gnomio.com/">https://in20ampccew.gnomio.com/</a>
44. By Prof. Dr. Malini Bapat - Saturday, 27 June 2020, 2:05 PM <a href="https://ccoew2020chem.gnomio.com">https://ccoew2020chem.gnomio.com</a>	64. By Prof. MANDAR VAHADNE - Sunday, 28 June 2020, 2:23 PM <a href="https://som20mavccew.gnomio.com">https://som20mavccew.gnomio.com</a>
45. By Prof. Manisha Narwane - Saturday, 27 June 2020, 2:34 PM <a href="https://ia20mpnccew.gnomio.com">https://ia20mpnccew.gnomio.com</a>	65. By Prof. Dr. Dipti Patil - Sunday, 28 June 2020, 3:52 PM <a href="https://bi20ddpccew.gnomio.com/">https://bi20ddpccew.gnomio.com/</a>
46. By Prof. Megha Borse - Saturday, 27 June 2020, 3:24 PM Moodle URL: <a href="https://nt20msbccew.gnomio.co">https://nt20msbccew.gnomio.co</a>	66. By Prof. Snehal Natekar - Sunday, 28 June 2020, 6:40 PM <a href="https://edc20sanccew.gnomio.com">https://edc20sanccew.gnomio.com</a>
47. By Prof. Dr. Saili Belsare - Saturday, 27 June 2020, 3:55 PM <a href="https://pefspbccew.gnomio.com">https://pefspbccew.gnomio.com</a>	67. By Prof. Rujuta Agavekar - Sunday, 28 June 2020, 7:39 PM <a href="https://conm20raaccw.gnomio.com/">https://conm20raaccw.gnomio.com/</a>
48. By Prof. Dr. Saili Belsare - Saturday, 27 June 2020, 4:02 PM <a href="https://pefspbccew.gnomio.com">https://pefspbccew.gnomio.com</a>	68. By Prof. Dnyaneshwar Bhosale - Sunday, 28 June 2020, 7:55 PM <a href="https://drbhosale.gnomio.com/course/view.php?id=3">https://drbhosale.gnomio.com/course/view.php?id=3</a>
49. By Prof. sagar vanarase - Saturday, 27 June 2020, 4:40 PM <a href="https://cnssvccew.gnomio.com/">https://cnssvccew.gnomio.com/</a>	69. By Prof. Dr. Anand Joshi - Monday, 29 June 2020, 9:54 AM <a href="https://science6stmaryschool.gnomio.com">https://science6stmaryschool.gnomio.com</a>
50. By Prof. Jyoti Chitale - Saturday, 27 June 2020, 5:15 PM <a href="https://qc20jscccew.gnomio.com/">https://qc20jscccew.gnomio.com/</a>	70. By Prof. prof. Aparna pai - Monday, 29 June 2020, 10:00 AM <a href="https://qc20aapccew.gnomio.com">https://qc20aapccew.gnomio.com</a>
51. By Prof. Amit Rajurkar - Saturday, 27 June 2020, 5:19 PM <a href="https://ee20aprccew.gnomio.com">https://ee20aprccew.gnomio.com</a>	71. By Prof. Sneha Thombre - Monday, 29 June 2020, 10:06 AM <a href="https://sktccewtest.gnomio.com/">https://sktccewtest.gnomio.com/</a>
52. By Prof. Dr Anita Jain - Saturday, 27 June 2020, 5:32 PM <a href="https://probandstatistics.gnomio.com/">https://probandstatistics.gnomio.com/</a>	72. By Prof. Sangita Gambhir - Monday, 29 June 2020, 10:28 AM <a href="https://sgsamplecourse.gnomio.com">https://sgsamplecourse.gnomio.com</a>
53. By Prof. Vishwanath Mali - Saturday, 27 June 2020, 6:11 PM <a href="https://qualityengineering2020.gnomio.com/my/">https://qualityengineering2020.gnomio.com/my/</a>	73. By Prof. Anjali Naik - Monday, 29 June 2020, 12:34 PM <a href="https://softcomputingccoew.gnomio.com">https://softcomputingccoew.gnomio.com</a>
54. By Prof. Madhura Tokekar - Saturday, 27 June 2020, 6:15 PM <a href="https://course4101ay2021.gnomio.com">https://course4101ay2021.gnomio.com</a>	
55. By Prof. Nilesh Ramesh Kolhalkar Saturday, 27 June 2020, 7:35 PM <a href="https://eg20nrkccew.gnomio.com/login/index.php">https://eg20nrkccew.gnomio.com/login/index.php</a>	
56. By Prof. Kalpana Joshi - Saturday, 27 June 2020, 9:28 PM <a href="https://pe20ksjccew.gnomio.com">https://pe20ksjccew.gnomio.com</a>	



74. By Prof. Aparna Hajare - Monday, 29 June 2020, 12:43 PM <a href="https://daa20auhccew.gnomio.com">https://daa20auhccew.gnomio.com</a>	90. By Prof. Mahendra Deore - Wednesday, 1 July 2020, 5:09 PM <a href="https://cn20mpdccew.gnomio.com/">https://cn20mpdccew.gnomio.com/</a>
75. By Prof. Mrs.Varsha Pimprale - Monday, 29 June 2020, 12:44 PM <a href="https://qc20vspccew.gnomio.com">https://qc20vspccew.gnomio.com</a>	91. By Prof. Dr. Mrudul Dixit - Wednesday, 1 July 2020, 9:54 <a href="https://qc20madccew.gnomio.com/my/">https://qc20madccew.gnomio.com/my/</a>
76. By Prof. Sanjivani Mane - Monday, 29 June 2020, 12:55 PM <a href="https://moodlefdp2020.gnomio.com">https://moodlefdp2020.gnomio.com</a>	92. By Prof. Nutan Deshmukh - Wednesday, 1 July 2020, 10:11 PM <a href="https://nutandeshmukh.gnomio.com">https://nutandeshmukh.gnomio.com</a>
77. By Prof. Sanjivani Mane - Monday, 29 June 2020, 1:14 PM <a href="https://psdl20sumccew.gnomio.com">https://psdl20sumccew.gnomio.com</a>	93. By Prof. Anita Patil - Thursday, 2 July 2020, 12:53 PM Power Electronics- <a href="https://pe20asp.gnomio.com">https://pe20asp.gnomio.com</a>
78. By Prof. Avinash Shinde - Monday, 29 June 2020, 1:27 PM <a href="https://eg20assccew.gnomio.com/">https://eg20assccew.gnomio.com/</a>	94. By Prof. Harsha Sonune - Thursday, 2 July 2020, 12:26 PM <a href="https://harshatry1.gnomio.com">https://harshatry1.gnomio.com</a>
79. By Prof. Pradnya Nanavare - Tuesday, 30 June 2020, 10:47 AM <a href="https://prn20.gnomio.com">https://prn20.gnomio.com</a>	95. By Prof. Tilottama Barhate - Thursday, 2 July 2020, 12:46 PM <a href="https://tbmoodle.gnomio.com">https://tbmoodle.gnomio.com</a>
80. By Prof. shilpa pant - Tuesday, 30 June 2020, 12:55 PM <a href="https://dsco20sppccew.gnomio.com/">https://dsco20sppccew.gnomio.com/</a>	96. By Prof. Harsha Sonune - Thursday, 2 July 2020, 4:11 PM <a href="https://harshatry1.gnomio.com/my/">https://harshatry1.gnomio.com/my/</a>
81. By Prof. Sheetal Barekar - Tuesday, 30 June 2020, 1:38 PM <a href="https://dsco20ssbccew.gnomio.com/course/view.php?id=2">https://dsco20ssbccew.gnomio.com/course/view.php?id=2</a>	97. By Prof. Ashutosh Muchrikar - Thursday, 2 July 2020, 5:33 PM <a href="https://anm123.gnomio.com/">https://anm123.gnomio.com/</a>
82. By Prof. prof.Aparna pai - Tuesday, 30 June 2020, 9:32 PM <a href="https://qc20aapccew.gnomio.com">https://qc20aapccew.gnomio.com</a>	98. By Prof. Prakash Date - Thursday, 2 July 2020, 6:35 PM <a href="https://dsa120pgdccew.gnomio.com/course/view.php?id=2">https://dsa120pgdccew.gnomio.com/course/view.php?id=2</a>
83. By Prof. Sanjivani Mane - Wednesday, 1 July 2020, 12:18 PM <a href="https://psdl20sumccew.gnomio.com">https://psdl20sumccew.gnomio.com</a>	99. By Prof. Saurabh Mengale - Thursday, 2 July 2020, 6:45 PM <a href="https://qc20spmccew.gnomio.com">https://qc20spmccew.gnomio.com</a>
84. By Prof. Dr. Revati Shriram - Wednesday, 1 July 2020, 12:19 PM <a href="https://dt20rvsccew.gnomio.com/">https://dt20rvsccew.gnomio.com/</a>	100. By Prof. Ashutosh Muchrikar - Thursday, 2 July 2020, 7:17 PM Resubmitting <a href="https://anm123.gnomio.com/">https://anm123.gnomio.com/</a>
85. By Prof. Dr. Anand Bewoor - Wednesday, 1 July 2020, 12:34 PM <a href="https://rdmss20akbccew.gnomio.com/course/view.php?id=2">https://rdmss20akbccew.gnomio.com/course/view.php?id=2</a>	101. By Prof. Milind Kolambe - Thursday, 2 July 2020, 9:53 PM Link : <a href="https://dbms20mnkccew.gnomio.com/">https://dbms20mnkccew.gnomio.com/</a>
86. By Prof. Dr. Sandhya Arora - Wednesday, 1 July 2020, 12:38 PM <a href="https://stats20sacccew.gnomio.com/">https://stats20sacccew.gnomio.com/</a>	102. By Prof. Anita Patil - Thursday, 2 July 2020, 10:26 PM <a href="https://pe20asp.gnomio.com/my/">https://pe20asp.gnomio.com/my/</a>
87. By Prof. Hitendra Khairnar - Wednesday, 1 July 2020, 12:44 PM <a href="https://qc20hskccew.gnomio.com/">https://qc20hskccew.gnomio.com/</a>	103. By Prof. Dr. Seema Rajput - Thursday, 2 July 2020, 10:32 PM <a href="https://vd20shrccew.gnomio.com">https://vd20shrccew.gnomio.com</a>
88. By Prof. Hitendra Khairnar - Wednesday, 1 July 2020, 12:48 PM <a href="https://qc20hskccew.gnomio.com/">https://qc20hskccew.gnomio.com/</a>	104. By Prof. Dr. Shilpa Deshpande - Thursday, 2 July 2020, 10:54 PM <a href="https://cc20ssdccew.gnomio.com">https://cc20ssdccew.gnomio.com</a>
89. By Prof. Madhura Tokekar - Wednesday, 1 July 2020, 3:34 <a href="https://course4101ay2021.gnomio.com">https://course4101ay2021.gnomio.com</a>	105. By Prof. Pallavi Ghatkamble - Thursday, 2 July 2020, 11:02 PM <a href="https://deppkccew.gnomio.com/">https://deppkccew.gnomio.com/</a>
	106. By Prof. Sneha Singh - Friday, 3 July

2020, 12:43 <a href="https://qc20ssccew.gnomio.com/course/index.php">https://qc20ssccew.gnomio.com/course/index.php</a>	121. By Prof. Nitin Patil - Saturday, 4 July 2020, 10:39 PM <a href="https://tsd20nrpcccew.gnomio.com/">https://tsd20nrpcccew.gnomio.com/</a>
107. By Prof. Sneha Singh - Friday, 3 July 2020, 12:48 AM <a href="https://qc20ssccew.gnomio.com/course/index.php">https://qc20ssccew.gnomio.com/course/index.php</a>	122. By Prof. Simantinee Kulkarni - Sunday, 5 July 2020, 3:44 PM <a href="https://fpl20svkccew.gnomio.com/course/view.php?id=2">https://fpl20svkccew.gnomio.com/course/view.php?id=2</a>
108. By Prof. Rupali Pawar - Friday, 3 July 2020, 7:57 AM Moodle link is: <a href="https://edc20rspcccew.gnomio.com/">https://edc20rspcccew.gnomio.com/</a>	123. By Prof. Neha Korla - Sunday, 5 July 2020, 4:07 PM <a href="https://ppl20nkcccew@gnomio.com">https://ppl20nkcccew@gnomio.com</a>
109. By Prof. Manjusha Bhosale - Friday, 3 July 2020, 10:30 AM <a href="https://qc20akbcccew.gnomio.com">https://qc20akbcccew.gnomio.com</a>	124. By Prof. Gitanjalee Salunkhe - Sunday, 5 July 2020, 6:48 PM <a href="https://dsa20gssccew.gnomio.com">https://dsa20gssccew.gnomio.com</a>
110. By Prof. Dr. Gautam Chandekar - Friday, 3 July 2020, 10:48 AM <a href="https://asm20gsccew.gnomio.com/">https://asm20gsccew.gnomio.com/</a>	125. By Prof. Vidya Sisale - Sunday, 5 July 2020, 8:35 PM Moodle link <a href="https://entc2020ccoew.gnomio.com">https://entc2020ccoew.gnomio.com</a>
111. By Prof. Harish Shinde - Friday, 3 July 2020, 11:02 AM <a href="https://at20hmscccew.moodlecloud.com/">https://at20hmscccew.moodlecloud.com/</a>	126. By Prof. sagar vanarase - Sunday, 5 July 2020, 9:25 PM <a href="https://cnssvcccew.gnomio.com/course/">https://cnssvcccew.gnomio.com/course/</a>
112. By Prof. Sunil Divekar - Friday, 3 July 2020, 11:09 AM <a href="https://mt120spdccew.gnomio.com/">https://mt120spdccew.gnomio.com/</a>	127. By Prof. Prof. Snehal Patil - Sunday, 5 July 2020, 9:29 PM <a href="https://snehalpatil2020.gnomio.com/">https://snehalpatil2020.gnomio.com/</a>
113. By Prof. Praful Meshram - Friday, 3 July 2020, 1:42 PM <a href="https://ds120hswcccew.gnomio.com/">https://ds120hswcccew.gnomio.com/</a>	128. By Prof. Vidya Sisale - Sunday, 5 July 2020, 9:49 PM <a href="https://entc2020ccoew.gnomio.com/my/">https://entc2020ccoew.gnomio.com/my/</a>
114. By Prof. Praful Meshram - Friday, 3 July 2020, 1:42 PM <a href="https://ds120hswcccew.gnomio.com/">https://ds120hswcccew.gnomio.com/</a>	129. By Prof. Prof. Snehal Patil - Sunday, 5 July 2020, 9:51 PM <a href="https://snehalpatil2020.gnomio.com/">https://snehalpatil2020.gnomio.com/</a>
115. By Prof. Dr.Nivedita Daimiwale - Friday, 3 July 2020, 6:30 PM <a href="https://fbmiccoew2020.gnomio.com/course/view.php?id=5">https://fbmiccoew2020.gnomio.com/course/view.php?id=5</a>	130. By Prof. Ajit Bhosale - Sunday, 5 July 2020, 9:54 PM <a href="https://aac20aabcccew.gnomio.com/">https://aac20aabcccew.gnomio.com/</a>
116. By Prof. Harshad Wadkar - Friday, 3 July 2020, 7:55 PM <a href="https://ds120hswcccew.gnomio.com/">https://ds120hswcccew.gnomio.com/</a>	131. By Prof. Milind Patankar - Sunday, 5 July 2020, 10:20 PM Network Theory : - <a href="https://nt20mspcccew.gnomio.com/">https://nt20mspcccew.gnomio.com/</a>
117. By Prof. Ganesh Padalkar - Friday, 3 July 2020, 8:15 PM <a href="https://et2021grpcccew.gnomio.com/">https://et2021grpcccew.gnomio.com/</a>	132. By Prof. Bageshree Pathak - Sunday, 5 July 2020, 10:39 PM <a href="https://csgccoew@gnomio.com">https://csgccoew@gnomio.com</a>
118. By Prof. Sandeep Musale - Friday, 3 July 2020, 8:45 PM <a href="https://ssm2021cccew.gnomio.com">https://ssm2021cccew.gnomio.com</a>	133. By Prof. Nilofar Kittad - Sunday, 5 July 2020, 11:28 PM <a href="https://qc20nskcccew.gnomio.com">https://qc20nskcccew.gnomio.com</a>
119. By Prof. Mahesh Pote - Friday, 3 July 2020, 9:18 PM <a href="https://mkp20etcccew.gnomio.com">https://mkp20etcccew.gnomio.com</a>	134. By Prof. Shridhar Kedar - Monday, 6 July 2020, 9:33 AM <a href="https://fm20sakcccew.moodlecloud.com/">https://fm20sakcccew.moodlecloud.com/</a>
120. By Prof. Shubhangi Chaudhary - Friday, 3 July 2020, 11:48 PM <a href="https://mspsrc20cccew.gnomio.com/">https://mspsrc20cccew.gnomio.com/</a>	135. By Prof. Sachin Paranjape - Monday, 6 July 2020, 10:41 AM Data Structures <a href="https://ds20sapcccew.gnomio.com/">https://ds20sapcccew.gnomio.com/</a>
	136. By Prof. Jyoti Bangare - Monday, 6 July 2020, 2:46 PM <a href="https://dbms20jlbcccew.gnomio.com/">https://dbms20jlbcccew.gnomio.com/</a>
	137. By Prof. Meenal Kamlakar - Monday, 6 July 2020, 6:28 PM <a href="https://cagccoew@gnomio.com">https://cagccoew@gnomio.com</a>

138.	By Prof. Ashok Khedkar - Monday, 6 July 2020, 7:25 PM <a href="https://ark20etccoew.gnomio.com">https://ark20etccoew.gnomio.com</a>
139.	By Prof. Dr.Madhuri Purandare - Monday, 6 July 2020, 8:01 PM <a href="https://map2020ccoew@gnomio.com">https://map2020ccoew@gnomio.com</a>
140.	By Prof. Dr. Atul Joshi - Tuesday, 7 July 2020, 5:09 PM <a href="https://lic20akjccew.gnomio.com">https://lic20akjccew.gnomio.com</a>
141.	By Prof. Namrata Karandikar - Wednesday, 8 July 2020, 9:32 PM <a href="https://mi20npkccew.gnomio.com">https://mi20npkccew.gnomio.com</a>
142.	By Prof. Ratnaprabha Borhade - Thursday, 9 July 2020, 12:07 PM <a href="https://qc20rrbccew.gnomio.com">https://qc20rrbccew.gnomio.com</a>

- After successful completion/fulfilling certificate criteria, faculties had received certificate. One such example is shown below.



### Report on 'SWAYAM NPTEL MOOCs Courses' related to 'Teaching -Learning Pedagogy Course' completed

A. Y.	Course Duration	Nos.
2019-20	Jan – April 2020	3
	July- Nov 2019	0
2018-19	Jan – April 2019	0
	July- Nov 2018	4
2017-18	Jan – April 2018	7
	July- Nov 2017	3

Sr. no	Course Name	Name	Department	Certificate Type
<b>Jan – April 2020</b>				
1	Design and pedagogy of the introductory programming course	Hitendra Shankarrao Khairnar	Computer Science and Engineering	
2	Design and pedagogy of the introductory programming course	Anjali Milind Naik	Computer Science and Engineering	
3	Design and pedagogy of the introductory programming course	Shital Sachin Barekar	Computer Science and Engineering	
<b>July- Nov 2018</b>				
1	Outcome based pedagogic principles for effective teaching	Bageshree Pathak	Electronics and Communication Engineering	Elite
2	Outcome based pedagogic principles for effective teaching	Pratima Kulkarni	Instrumentation Engineering	Elite
3	Outcome based pedagogic principles for effective teaching	Amruta Gajanan Bahulikar	Instrumentation Engineering	Successfully completed
4	Outcome based pedagogic principles for effective teaching	Asmita T. Wakankar	Instrumentation Engineering	Elite
<b>Jan-April 2018</b>				
1	Effective Engineering Teaching in Practice	Chhaya S. Gosavi	Computer Science and Engineering	Elite
2	Effective Engineering Teaching in Practice	Shilpa Pravin Pant	Computer Science and Engineering	Elite

3	Effective Engineering Teaching in Practice	Vaishali Mahesh Salgar	Computer Science and Engineering	Elite	
4	Effective Engineering Teaching in Practice	Sagar Sudhakar Vanarase	Electronics and Communication Engineering	Elite	
5	Effective Engineering Teaching in Practice	Swati Prashant Madhe	Instrumentation Engineering	Elite	
6	Effective Engineering Teaching in Practice	Vaishali Manohar Upadhye	Instrumentation Engineering	Elite	
7	Effective Engineering Teaching in Practice	Mandar Ashokrao Vahadne	Mechanical Engineering	Elite	
<b>July-Oct 2017</b>					
1	Outcome based pedagogic principles for effective teaching	Manisha Jail	Basic Sciences and Humanities	Elite	
2	Outcome based pedagogic principles for effective teaching	Prof. Dr. Ashwini M. Deshpande	Electronics and Communication Engineering	Elite	
3	Outcome based pedagogic principles for effective teaching	Sharada Narsingrao Ohatkar	Electronics and Communication Engineering	Elite	

### Report on the usage report for the 'COURSERA Learning Program' for students and faculty of Cummins College of Engg. for Women Pune

- ❖ To develop self-learning abilities and facilitate them to lean new / inter-discipline courses offered by internationally reputed Universities, CCEW College has subscribed institute licence for 'COURSERA Learning Program'.
- ❖ The usage report for the Coursera learning program is studied and the latest updated is accessed. Following is a summary of programme usage;

Information Items	Nos.
Total enrolments	10588
Total unique learners	1341
Learners who have enrolled in at least one course	1338
Current members	1390
Removed members	6
Total unique courses	1426
Total course completions	2709
Total verified course completions	2709
Total unique course completers	809
Total estimated hours spent	36449
Learners who have completed 50% of a course	914
Learners who have joined the program but have not enrolled in a course	52
Learners who have enrolled in a course but have not completed any course	532
Learners who have enrolled in 1 course	205
Learners who have completed 1 course	269
Learners who have enrolled in 2 courses	169
Learners who have completed 2 courses	187
Learners who have enrolled in more than 2 courses	967
Learners who have completed more than 2 courses	353