Papers

Making Online Teaching-Learning Process More Effective by Blending Various ICT Tools

Making Online Teaching-Learning Process More Effective by Blending Various ICT Tools

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Abstract— World Health Organization has announced COVID-19 as a pandemic. The Coronavirus which was estimated that it was originated from Wuhan, China is widespread across the world. Due to this pandemic situation education industry has shifted from regular classroom teaching-learning to online teaching-learning. To transfer knowledge of various subjects' variety of platforms were adopted so that respective subject knowledge will be dispersed amongst students effectively. One of the most important hurdles is that to ensure that students are engaged effectively in online teaching-learning mode as it is a new era to them also. In this paper, various ICT tools were used for the class of third-year mechanical engineering students for the subject advance manufacturing process. The tools are selected in a way that students can be leveraged from remembering level to application level. The active learning tools are selected keeping in mind that the end semester examination of students will be on the multiple-choice question type. The ultimate aim to use specific platforms and active learning tools is that to improve subject results and subject understanding. The platforms adopted for online teaching-learning are Socrative, Moodle, MS Team, and Google Forms. The active learning techniques incorporated in the teaching-learning process are Online Quizzes, Assignments, Peer Questioning & Discussion Forums. The study population of this action research is the third-year Mechanical engineering students (N=79; males=74; females=05). In the end, outcomes and feedback were discussed about the efficacy of the ICT tools on overall subject result and understanding.

***Keywords*—AMP-Advance Manufacturing Processes, CO-Course Outcomes. Online Quizzes, Online Assignments, Discussion Forums, Peer Questioning**

I. INTRODUCTION

The pandemic situation for last two years have affected and completely transformed the teaching learning process from all levels in education industry. There has a technology transfer and urge to update from teacher and student side [8]. All education has to be shifted to online teaching from the traditional teaching-learning process. As a teacher, it is a very difficult task to deliver all lectures of respective courses in a very effective manner. Despite extensive study, we still have little understanding of how variations in learning activities affect students' learning [10]. When there is a traditional teaching process going on to establish the delivery of talks more effective there are heaps of active and collaborative learning techniques were available, which will guarantee the active participation of pupils in a course of study. But as due to the sudden lockdown due to pandemic to deliver lectures effectively and to ensure active participation of students in a class the use of ICT tools is the most important demand of the online teaching-learning process. For the course Advance Manufacturing Processes (AMP) for the class of third-year diploma mechanical students, online teaching-learning was blended with various active learning techniques with the use of ICT tools. There are many cooperative and collaborative active learning techniques that have enhanced the learning experience of off-line learning methods. However, the transformation was needed to cope with the COVID-19 e-learning methods [3]. The active learning techniques used in the AMP course are Online Quizzes, Online Assignments, Discussion, Forums, and Peer Questioning, by using various ICT platforms like Socrative, Moodle, and MS T8eam. The ultimate aim of all the efforts done is to deliver lectures and the course effectively, and engage students in the course actively.

The active learning techniques chosen are implemented in a manner that the level of understanding of students will be increased from basic remembering to applying. At the end of the semester, feedback was taken to check the effectiveness of the various active learning techniques used during the whole semester. Also, active student feedback can be employed efficaciously in online lecture courses and learning milieus, which use techniques such as active learning. Employing student feedback gives students an element of control in their learning atmosphere. This element of control can be very emancipate for students and usually has a very constructive

effect on the learning process. Students become more engaged in and responsible for their own learning experience. As technical Education has a significant role in human resource development of a country in creating capable, knowledgeable and skilled manpower [4].

This paper will discuss various active learning whisked with the online teaching-learning process, and results yield in terms of achieving attainment targets and the overall result of the course.

II. Purpose and Motivation

The purpose and the ultimate motivation of all active learning techniques used are shown in figure.1. Figure no 1 shows the purpose to use various active learning techniques to achieve ultimate aim that is improve understanding and subject result. The various parameters considered are student involvement, management skills, encouragement and out of the box thinking. There are still many issues and shortfalls among young graduates, despite the initiatives taken by the government to address the issue. The adoption and practice of active learning approaches into the component of course design offered in higher institutions is a common practice nowadays and is crucial in addressing these weaknesses among our young graduates [1].

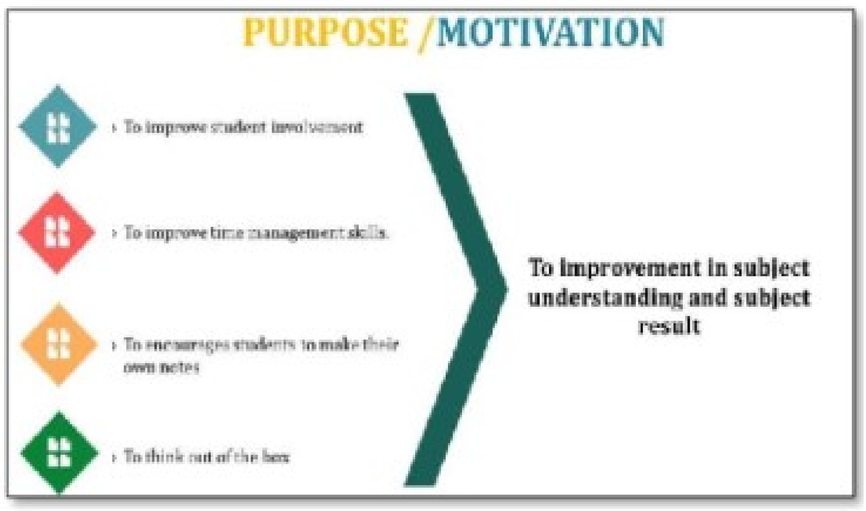


Figure. 1. Flowchart of purpose and motivation

III. Details of Methodologies

In this paper, the various active learning methodologies adopted for the course AMP by using various ICT tools, to make the sessions more interactive and live have been discussed. Since Advance Manufacturing Process is a mixture of a theoretical and numerical based subject, the adaptations of newer pedagogical teaching methods will help the students to get a great hold of the subject in the prescribed time and also will make them Industry ready.

The methodologies adopted for Online Classroom Teaching and Laboratory Teaching were

A. Online Quizzes
B. Online Assignments
C. Discussion Forums
D. Peer Questioning

To implement the above-said methodologies the ICT tools used were

i. Socrative Application
ii . Moodle
iii. MS Team
iv. Google Forms

A. Online Quizzes

The assessment and evaluation too needs to transform from traditional way to online method, meeting the requirements of pandemic policies. The online assessment and evaluation while practicing is found to be much better than the traditional one [9]. The online quizzes were developed in two stages. In the first stage as sown in figure 2, beat-wise quizzes were developed and implemented, and in the second stage as shown in figure 4 the unit wise quizzes were developed and implemented under the umbrella as Test Your Knowledge and in the third stage as shown in figure 6, a quiz was taken for the whole course. So the stages were implemented in a way that students will be engaged step by step in the whole course and they can able to study the whole course in a stepwise manner. In stage one some quizzes were developed on the identification of particular setup figurers and their basic component. For the first stage ICT tool used was Socrative application and stage number 2 the ICT tool was Google Forms and third stage the ICT platform used was Moodle. Generally, bit-wise quizzes consisting of 10 questions of 1 mark each; in the case of unit wise quizzes consist of 25 questions of 1 mark each. For stage no 2 that is for unit wise quizzes students were appreciated for their performance by awarding them a certificate for those who score more than 23 marks on a respective quiz.

The procedure of implementing online quiz activities is

- Faculty member creates a quiz using Socrative, Google Forms, and Moodle, he will shares a link with students and expects the students to take the quiz /test within the scheduled time
- The course teacher inform the students about their performance in terms of test scores as well as know the correct answer for the questions along with justification
- The summary of responses helps the course teacher to analyze the students' performance based on various parameters.
- Appreciating to students who have performed extraordinary in quizzes and motivating to those who lag in the study.

The aim of these multiple-choice choice quizzes was to prepare students ready for the final end semester examination. As it is declared by the Maharashtra State Board of Technical Education (MSBTE) that the examination for the AMP course will be objective type. So all activities run under these online quiz activities will be beneficial for students to get good marks and score more in End Semester Examination (ESE) final exam as well as in oral and practical examinations. The outcomes of all actives have been discussed in the result and discussion section.

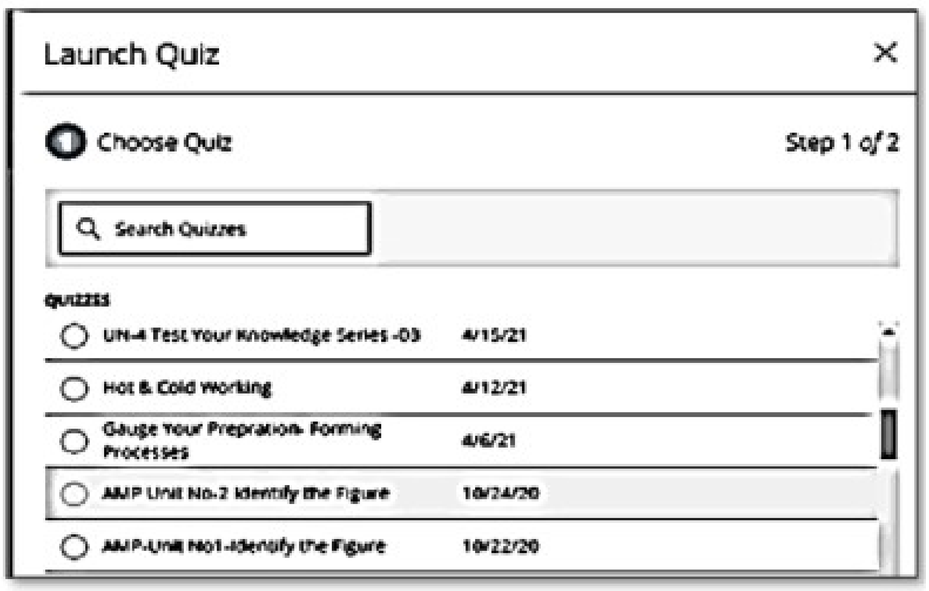


Figure. 2. Screenshot Socrative showing bitwise stage no 1 quiz

Figure. 3. Screenshot Socrative showing bitwise stage no 1 quizzes contd.

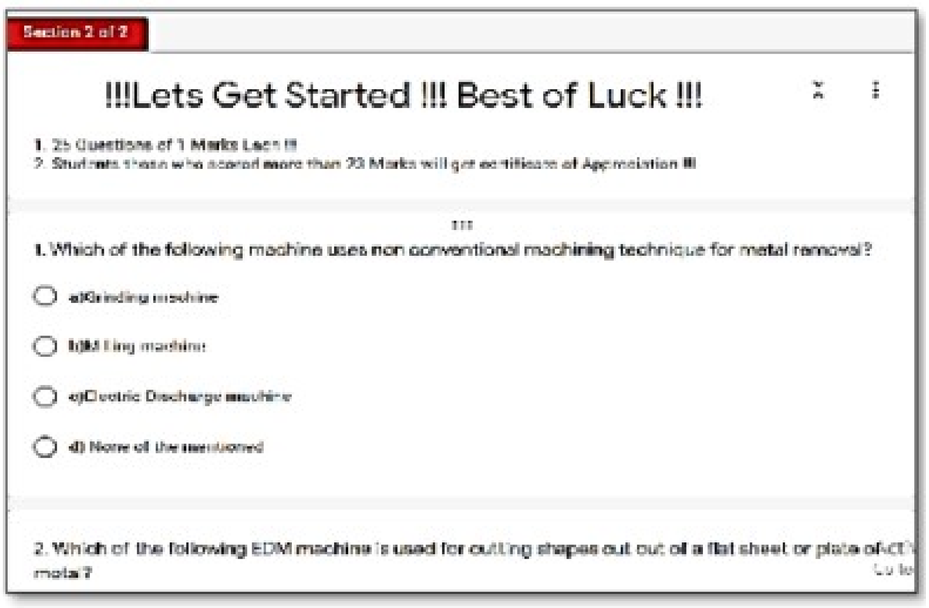


Figure. 4. Screenshot stage no 2 unit wise quiz on google forms

At one time the quiz was attempted by all students on google forms it was very comfortable to analyze where it can easily see that which are the frequently missed questions, average marks scored by students and median, etc. as shown in figure 5

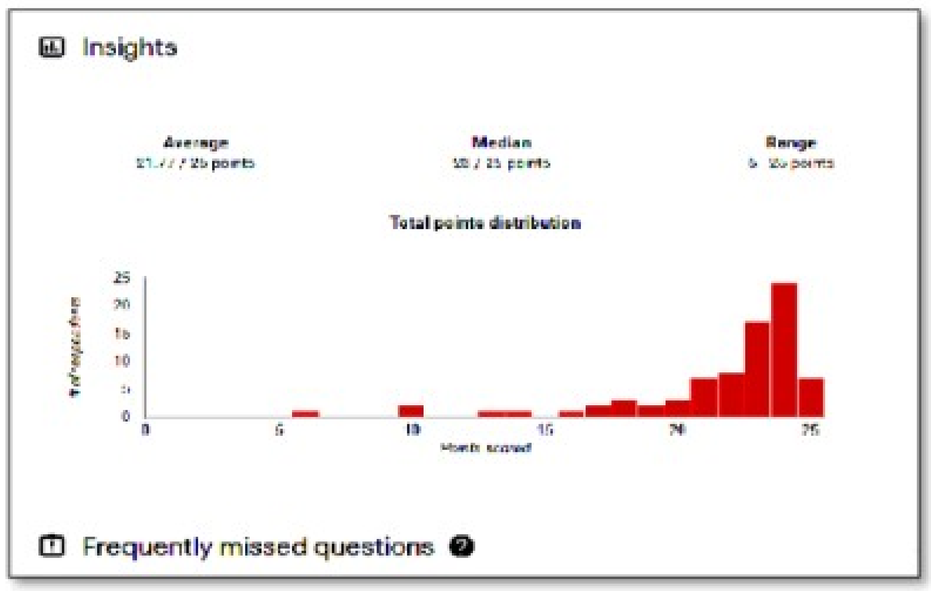


Figure. 5. Responses and Result Analysis of the Quiz

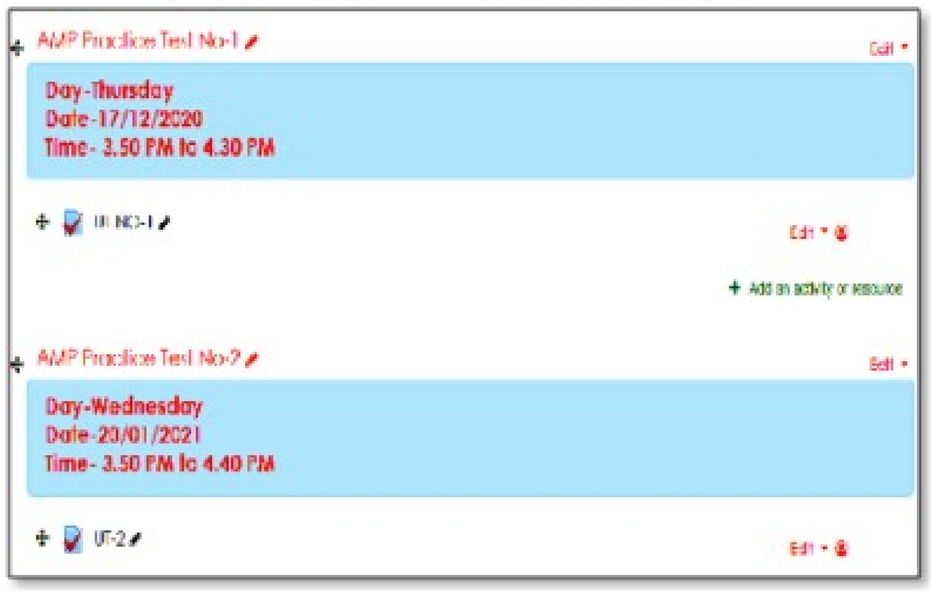


Figure. 6. Stage no 3 Test on the Whole Curriculum

B. Online Assignments

The second active learning was used as online assignments. As all activities in the teaching-learning process were online, to ensure that whether students were understanding the concepts and programming the tool used was online assignments. There was a peer assessment which could yield more learning benefits to the students and mentors with a good approach for course delivery [6]. To ensure 100% percentage participation of students in this activity, it is made mandatory for students to complete online assignments. This activity was made as a part of the submission, students will not get progressive assessment marks unless and until they submit online assignments in the given time. Common instructions were given to students about how to write assignments like they have to refer to reference books, journal papers only to write assignments on pages and after each answer, they have to write which reference they have used to write the answer for the given question.

Once students submit assignments, they were assessed and if any further corrections were required it is conveyed to the respective students. The sample of the online assignments taken is shown in figure 7

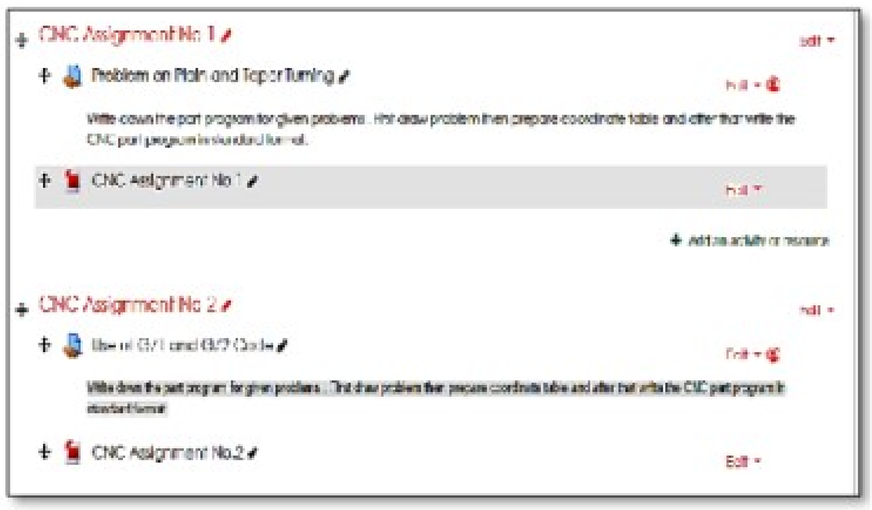


Figure. 7. Online Assignments Sample Screenshot

C. Discussion Forums

The third active learning technique used for the course Advance Manufacturing Processes (AMP) used was a discussion forum. This activity aimed to engage students in the course in such a way that they will learn the curriculum more than the prescribed syllabus. This activity was focused to cover content beyond the syllabus. Also, some of the content from content needs to be studied by students on their own, so discussion forums are taken in a way that students will learn on their own both content in the syllabus as well as beyond the syllabus. This also leads the students learning in curricular and Co-curricular development of the content of courses from regular curriculum[5]. Discussion forums are aimed to learn and collaborate amongst the students [7] the sample screenshot is shown in figure 8. The flow of activity is as follows.

- The first faculty member informs students about the topic on which they have to find information.
- Then faculty member posted a discussion forum on Moodle platform.
- Students have to summarize and study the information about the given topic.
- Then students will compile a summary about it and then they will reply to the forum.
- Once all students posted their replies during the lecture hour discussion will be carried out and final comments will be passed by a faculty member.

Figure. 8. Discussion Forum Sample Screenshot

D. Peer Questioning

The fourth active learning technique used for AMP course was Peer Questioning. This active learning technique was extensively used during lecture sessions. By using this technique faculty knows in what depth students understands the concept and whether they can apply these concepts and terminologies in micro-projects that are assigned to them.

BY using this peer questioning, active learning techniques one can promote higher order open ended questions were asked to promote thinking and generate a focused discussion in a class. Due to this technique, a teacher can know that whether students were actively involved in the lecture, whether they are listening to the delivery efficiently and how they correlate the terminologies to actual implementation.

The flow of activity is as follows.

- The activity is run in such a way that, faculty member teaches some part of the curriculum, then the Teacher exhibitor passes out a set of generic thought-provoking questions for students. Based on that point gives 5 to 10 minutes time to students to think about that.
- Students will think, search and collect data on the asked respective question.
- Randomly any students will be asked to unmute and allow to answer that question one by one. Students reflect on their learning in writing or in conversation
- Then they will discuss amongst themselves and come to a final answer.
- At last teacher with his expertise will make corrections if required and passes the comments about the asked question.

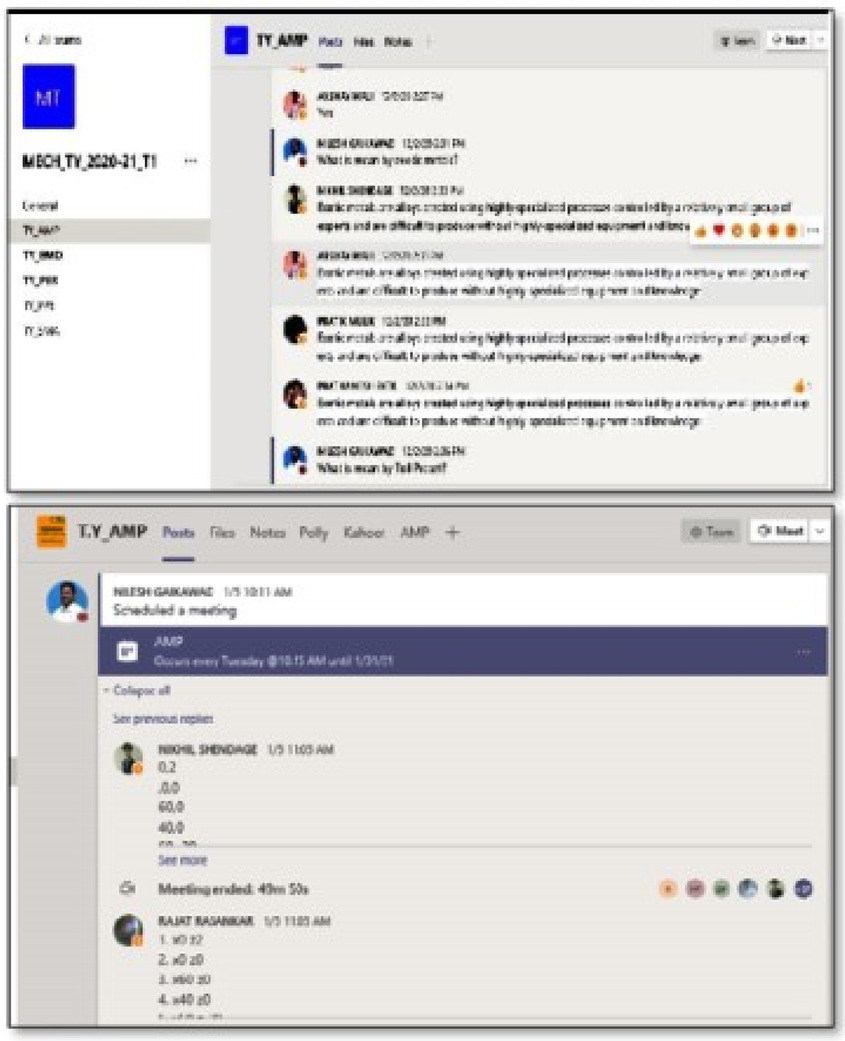


Figure. 9. Peer Questioning Sample Screenshot

IV. FEEDBACK AND ANALYSIS

An online survey form (using Google forms) titled "Feedback Form on Effectiveness of Use of Active Learning Techniques". A sample Screenshot of the online survey form is provided in Figure. 10. The techniques adopted were practiced for V semester diploma engineering students of the department of mechanical engineering. The google form was circulated to students, through WhatsApp who were part of the class which comprised 79 students. The quantitative findings were analyzed and presented below [2].

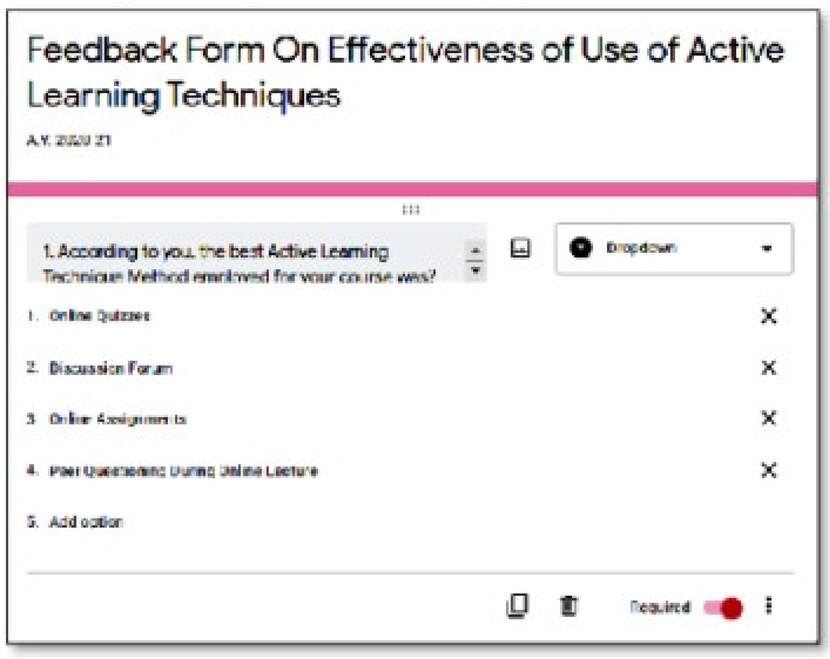


Figure. 10. Screenshot of the Online Survey Form

TABLE 1
FEEDBACK QUESTIONARIES' LIST

Question No.	Feedback Questions
01	According to you, the best Active Learning Technique Method employed for your course was?
02	According to you which activity is able to clear your doubts efficiently
03	What do you feel which activity was able to clear your concepts efficiently?
04	Do you think the execution of these Active Learning Techniques helped you to achieve a greater hold of the course?
05	What do you think the implementation of the Active Learning Techniques in the Classroom Lecture Sessions was good?
06	Do you recommend these techniques to be used in the future for upcoming batches
07	Do you think of the use of discussion forums you are able to study and understand content beyond the syllabus?
08	Do you feel that by the use of these various active learning techniques you are able to achieve course outcomes?
09	Do you feel that because of the use these active learning techniques will help you to score more marks in the end semester examination
10	Do you think that because of the use of these active learning techniques you are able to perform better in a practical and oral examination?

Out of 79, 67 students were responded to the given feedback survey. The students were given the link to the online survey form and sufficient time was stated for the students to go through the questions and submit their responses. After the collection of data from all 67 participants of the survey, the responses were analyzed. The detailed analysis of feedback is summarized in table 2.

The feedback is prepared in such way that students will give their true responses without any hesitation. The form did not have room for information such as the name and other personal details of the student, this anonymous submission was employed to make the participants more comfortable in answering the questions. The feedback form comprises 10 questions out of which 9 questions were related to the methodologies applied and the 10th question was to find the most efficient method employed according to the participants.

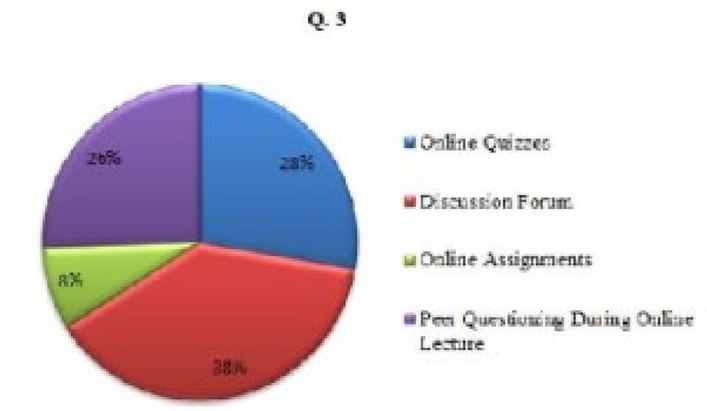
Likert scale was used to get responses to the questions, which had the options Yes, No, Maybe, and None of the above. The questions that appeared in the survey are listed down in table 1. Out of 79, 67 students was responded to the given feedback survey.

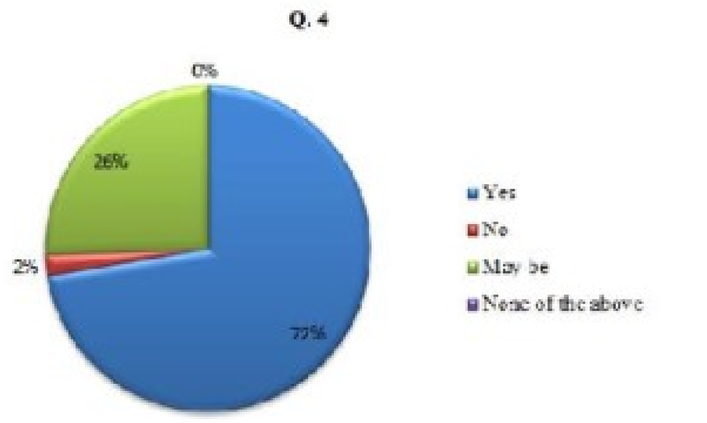
TABLE 2
FEEDBACK ANALYSIS

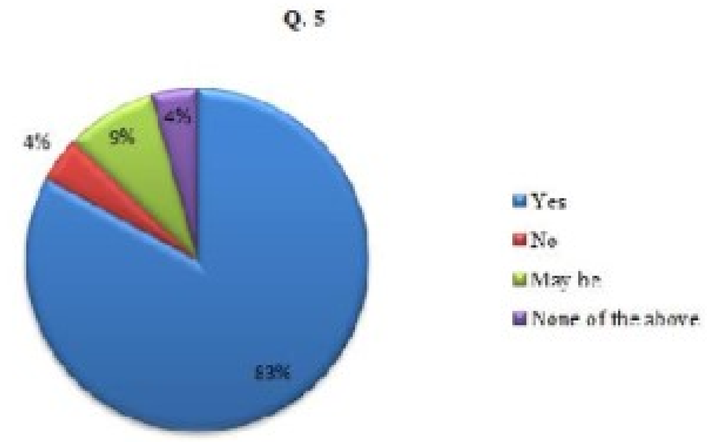
Question No.	Options			
	Option No 1	Option No 2	Option No 3	Option No 4
01	Online Quizzes 57.4%	Discussion Forum-21.3%	Online Assignments-Nill	Peer Questioning During Online Lecture-21.3%
02	Online Quizzes 27.7 %	Discussion Forum-31.9 %	Online Assignments-8.5 %	Peer Questioning During Online Lecture-31.9 %
03	Online Quizzes 27.7 %	Discussion Forum-38.3 %	Online Assignments-8.5 %	Peer Questioning During Online Lecture-25.5 %
04	Yes-72.3%	No-2.1%	May be- 25.5%	None of the above- Nil
05	Yes-83%	No-4.3%	May be- 8.5%	None of the above- 4.3%
06	Yes-66%	No-2.1%	May be- 29.8%	None of the above- 2.1%
07	Yes-91.5%	No-2.1%	May be- 4.3%	None of the above- 2.1
08	Yes-72.3%	No-6.4%	May be- 21.3%	None of the above- Nil
09	Yes-89.4%	No- Nil	May be- 6.4%	None of the above- 4.3%
10	Yes-74.5%	No-8.5%	May be-17%	None of the above- Nil

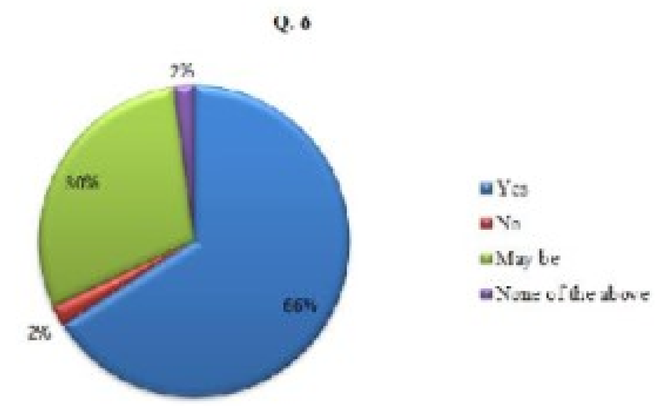
The data collected from the feedback form are enumerated here. To the first question, 57.4 % percentage of students thought that online quizzes were the most efficient active learning technique amongst all. For question, no second students were given survey, almost equal with the highest 31.9 % to the discussion forum. Again for question no third students were voted for discussion forum with 38.3 %. To question no 4 73 % percent of students were given feedback that using these all active learning activities helped them to get a greater hold on course. To question no 5, 83% percent of the students think that implementation of active learning techniques in classroom sessions was good. For question no 6, 66% of students recommended that these techniques should be used for upcoming batches. To question no 7, 91.5% of students think that discussion forums were helpful to them to study content beyond the syllabus and think out of the box.

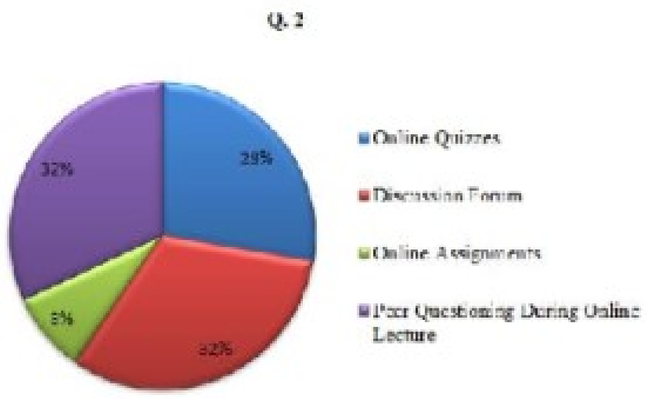
For question no 8, 72.3 % of students think that by using various active learning techniques they can achieve course outcomes of AMP. To question 9 & 10 students were given feedback 89.4% & 75 %, respectively which clearly illustrates that they were able to score more marks and perform better in the AMP course. It is visible from the responses and data generated by the above feedback questionaries' it cleared that students feel that all activities performed throughout the semester in the AMP course were good and it helped them to perform better in the end semester examination both theory and practical. There are very fewer percentages of students who thought that these activities will no help them in the respective course. All responses given by students for feedback are shown in figure 11.

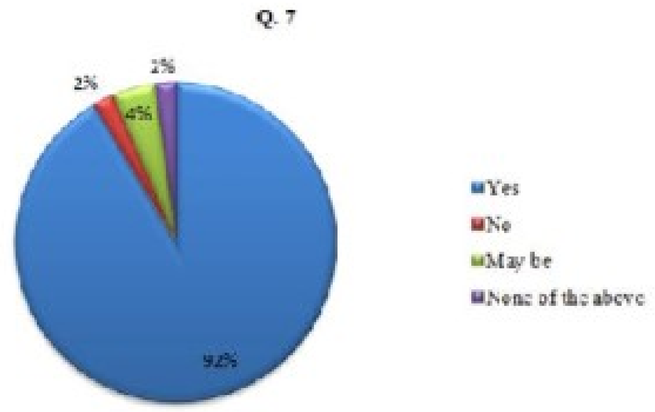












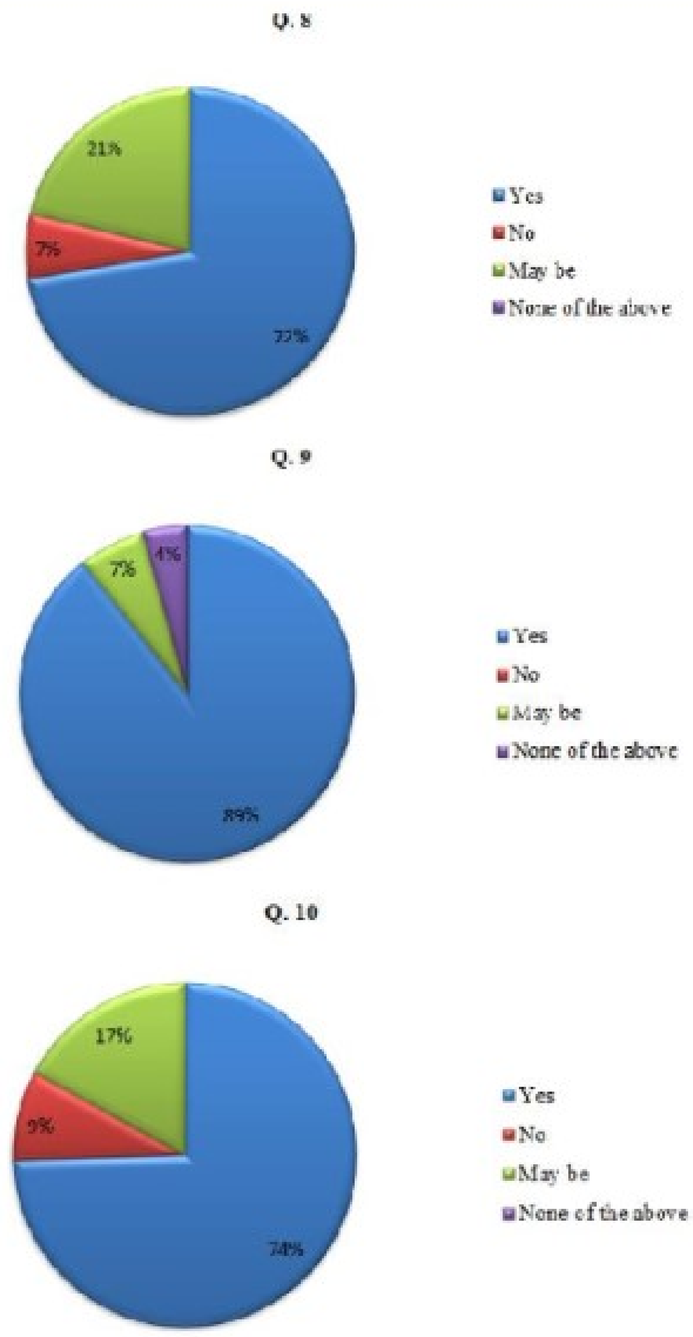


Figure. 11. Student Responses to all Feedback Questions

IV. Conclusion and Outcome

All the activities executed throughout the semester and their effectiveness were measured in two categories first one is in terms of the average result, marks secured by students in the end semester examination and the second one was in terms of attainment of all course outcomes. To get a clear idea those results and outcomes were compared with last year's result and attainment values. The end-semester examination was for 70 marks. The comparison data between the academic year 2019-20 & 2020-21 is encapsulated in table 3.

TABLE 3
ESE Result Comparison

Academic Year	Average Result	More than 60% (42 Marks)	More than 70% (49 Marks)	More than 80% (56 Marks)
2019-20	78.95 %	28.94 %	21.05	00 %
2020-21	98. 75 %	87.5 %	72.5 %	53.73 %

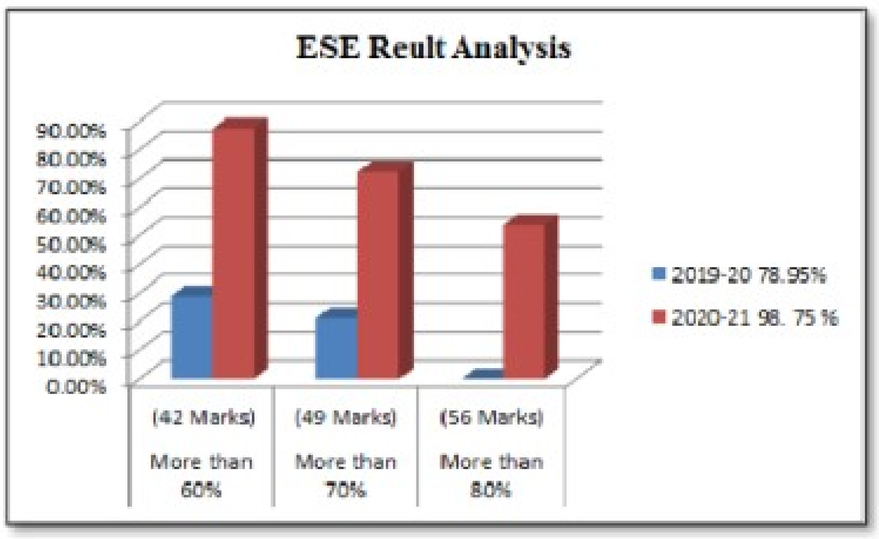


Figure. 12. Bar Chart of ESE Result Analysis

From table 3 and its representation in figure 12 shows that end semester examination result improved remarkably around 20 %. In table 3 comparisons are also carried out between minimum marks secured. The baseline considered here is first class marks, i.e. above 60%. It can be clearly seen that there is a rise in the percentage of students who are above 60 percentage category i.e scoring more than 42 marks. For more than 70 percentage baseline, there is a rise of 51.45 percentage and for more than 80 percentage baseline earlier, there were 00 students, but for academic year 2020-21 it increased to 53.73 percentage.

TABLE 4
Average Attainment Values Comparison

Academic Year	Attainment					
	CO 1	CO 2	CO 3	CO 4	CO 5	CO 6
2019-20	69.11	69.45	69.12	68.30	69.06	68.62
2020-21	81.9	81.7	81.65	80.71	80.99	81.46

In table 4 comparisons between attainment achieved by course AMP for academic year 2019-20 and 2020-21 is carried out.

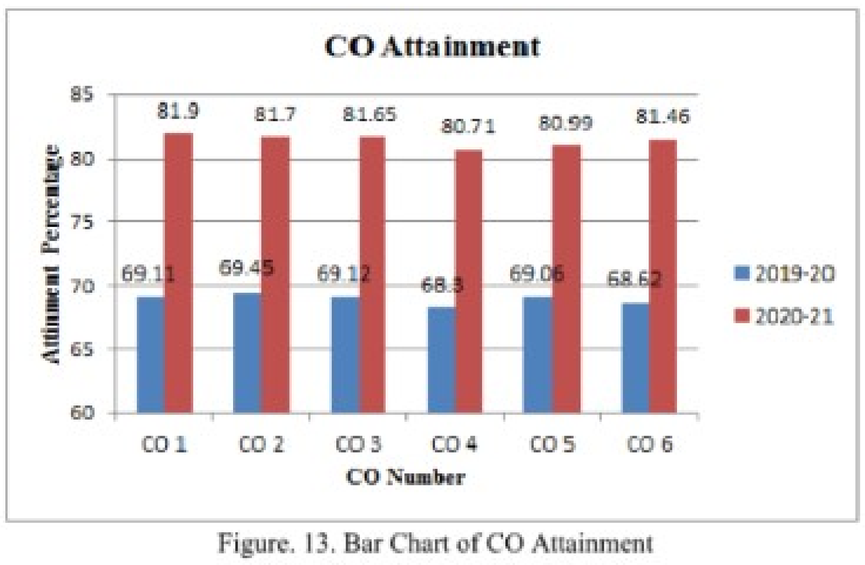


Figure. 13. Bar Chart of CO Attainment

Here attainment considered to be average attainment values. From table 4 it can be observed that for academic year 2019-20 average attainment values was in between 68 to 70 %. But for academic year 2020-21 the average attainment values were

in between 80 to 82 %. There is improvement of around 12 % in average attainment values.

So from both tables 3 and 4 it can be concluded that there is marked improvement in ESE result and average attainment values of each course outcome (CO). All active learning strategies implemented in AMP course have yielded their outcomes and with some improved modification the outcome of it can be improved.

V. References

[1] Y. Al-Odwan, "Effectiveness of active learning strategy in improving the acoustic awareness skills and understanding what is heard by the basic stage students in Jordan," academic journal, vol. Vol. 11(20), pp. pp. 1896-1905, October, 2016.

[2] G. Pilten, "The Evaluation of Effectiveness of Reciprocal Teaching Strategies on Comprehension of Expository Texts," Journal of Education and Training Studies, vol. Vol. 4, no. 10, 2016.

[3] Mhd Khori and Arimuliani Ahmad (2018) Enhancing Students' Reading Comprehension through the Collaboration between Reciprocal Teaching and Cooperative Learning, Advances in Social Science, Education and Humanities Research, vol.178.

[4] Jamila Shaaruddin, Maslawati Mohamad (2017). Identifying the Effectiveness of Active Learning Strategies and Benefits in Curriculum and Pedagogy Course for Undergraduate TESL Students, Scientific Research Publishing, Creative Education, 2017, 8, 2312-2324

[5] Abhilash Suryan, V Radhakrishnan (2021). Revision of Undergraduate Engineering Curriculum with Emphasis on Project-Based Teaching Learning Approach- Case Study of KTU, Journal of Engineering Education Transformations ,Volume 34 , No. 3, January 2021, ISSN 2349-2473, eISSN 2394-170.

[6] Kanika , Shampa Chakraverty , Pinaki Chakraborty (2021). Peer-Assessment Based Approach for Teaching Microprogramming, Journal of Engineering Education Transformations ,Volume 34 , No. 4, April 2021, ISSN 2349-2473, eISSN 2394-1707

[7] Sandhya Dass, Ramananda H S (2021). Effectiveness of Collaborative o Learning Among Gen Z Engineering Students, Journal of Engineering Education Transformations ,Volume 34 , No. 3, January 2021, ISSN 2349-2473, eISSN 2394-1707.

[8] Harshali Patil, Jesal Varolia, Deepali Joshi (2021). Teaching Learning Methods' Shift And Its Impact During Pandemic, Journal of Engineering Education Transformations ,Volume 35 , No. 3, August 2021, issue (Enhance Quality Education through NEP 2020) eISSN 2394-1707.

[9] Dr. Lochan Jolly, Mr. Arpit Vyas (2021). Innovation in online Evaluation for authentic assessment, Journal of Engineering Education Transformations ,Volume 35 , No. 3, August 2021, issue (Enhance Quality Education through NEP 2020) eISSN 2394-1707

[10].Dr. Pradosh Chandra Patnaik, Dr. Aslam Y. Suriya, Mudrakola Swapna (2021). Teaching Learning Process in Higher Education with the Impact of ICT: An Analytical Review, Journal of Engineering Education Transformations ,Volume 35 , No. 3, August 2021, issue (Enhance Quality Education through NEP 2020) eISSN 2394-1707

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