Intervention of Technology-Enhanced Teaching Pedagogy

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Abstract: Educational software and multimedia platforms are becoming increasingly common in the Higher Education (HE) System for improving instructors' and students' learning experiences. New Education Policy (NEP), technology advancements have helped to shift the focus of teacher design work from a faculty-centred to a student-centred outcome-based education system through the CAPSL program. Efforts have been made at the institute to improve classrooms and laboratories by utilising interactive technology. This paper examines the importance of teaching interventions, how they are implemented, and how they are evaluated to improve student's learning experiences. For this study, the intended audience is third-year Biotechnology students, and the subject is "Concepts in Biomedical Instrumentation (UBT532)". To evaluate the interventions, a set of descriptive and score-based questions has been prepared. Further, the new concept of think pair share activity was introduced in the class to see the creativity of the students. At the end of the course, the feedback from students is analysed using a graphical approach.

Keywords: Online Learning Platforms, Gamification, Adaptive Learning

1. Introduction:

Technology has revolutionized the field of education, offering numerous opportunities for enhanced teaching and learning activities. Here are some key ways available in literature in which technology has contributed to the development of technology-enhanced teaching and learning activities. (i) Online learning platforms have become increasingly popular, providing learners with access to a wide range of educational resources, courses, and learning materials [1-4]. These platforms enable educators to create interactive and engaging learning activities, such as online lectures, multimedia presentations, simulations, and virtual labs, which can enhance the learning experience for students. (ii)Gamification is the integration of game elements, such as points, badges, leader boards, and challenges, into educational activities to make learning more engaging and interactive. Technology has facilitated the

development of gamified learning activities, which can motivate students to actively participate and learn through immersive experiences [5-6].(iii) Adaptive learning uses technology to personalize the learning experience based on the individual needs and progress of learners. Adaptive learning platforms use algorithms and data analytics to track learners' performance and provide customized learning paths, resources, and assessments [7-9]. This allows learners to learn at their own pace and receive personalized feedback, resulting in improved learning outcomes. (iv)Technology has enabled the development of collaborative tools that facilitate communication and collaboration among students and teachers. These tools, such as discussion forums, virtual classrooms, and collaborative document editors, promote collaborative learning, problem-solving, and critical thinking skills[10-13].(v)Virtual Reality (VR) and Augmented Reality (AR) technologies have transformed the way learning experiences are delivered[12-15]. They provide immersive and interactive experiences that allow students to explore and interact with virtual environments or objects, bringing abstract concepts to life. For example, virtual field trips, anatomy simulations, and historical re-enactments using VR and AR can enhance students' understanding and engagement in the learning process. (vi) The proliferation of mobile devices has made learning accessible anytime, anywhere. Mobile learning, or m-learning, refers to the use of mobile devices, such as smartphones and tablets, for learning activities. Mobile apps, educational games, and other mobile learning tools provide students with on-the-go access to educational content, assessments, and collaborative activities, facilitating flexible and personalized learning experiences. (vii)Technology has enabled the collection and analysis of vast amounts of data related to learners' interactions with educational content, activities, and assessments. Data analytics and learning analytics tools can provide insights into students' learning behaviors, preferences, and performance, allowing educators to make data-informed decisions and personalize the learning experience [5-7].

So technology has greatly contributed to the development of technology-enhanced teaching and learning activities, providing educators with innovative tools and platforms to create engaging, personalized, and interactive learning experiences for students. As technology continues to evolve, we can expect further advancements in education, shaping the future of teaching and learning.

In this paper, the need of teaching interventions, implementation and its assessment to enhance the learning experience of the TIET Patiala, India students are discussed. The same is applicable to any other institute of higher education. Third year EIC (Electronics Instrumentation and Control) students are selected as targeted audience, and the concerned subject is power electronics and drives (Paper code-UEE701). A set of descriptive and score based questions are prepared to assess the interventions used. A graphical approach is adopted to analyse the feedback received from the students. To justify the efficacy and implementation of the proposed interventions, relevant evidences are analysed and some sample copies of supporting documents are attached as annexures for reference.

2. Need of teaching interventions:

In recent years, the academic community has significantly boosted its participation in the teaching and study of evolution in higher education (HE). Many formal mechanisms for improving the process of teaching and learning have been created through ISO, NACC, NBA, and ABET standards. Because of the technical programme stakeholders, our institute has grown into a worldwide global enterprise. In this direction, several partnerships/collaborations/MOUs are introduced for the improvement of the teaching and learning process. Interventions in teaching and learning activities are essential for improving adaptation. Some new initiatives like the Baggi project, ELC activity, capstone project, and project semester, are introduced to make learning more practical-oriented. All of these trends influence the learning experience. Furthermore, during a pandemic, it becomes vital to offer lessons online.

2.1. Objective of Interventions

The following objectives were targeted:

a) Creation of e-content for all of the courses taught during the pandemic years, which will be useful to both instructors and students as a supplement. Also, it serves as a backup for students who miss classes.
b) Lecture material developed through LMS was provided to the students
c) In my view, various course material and other video lectures like NPTEL, **etc**. available through the website are not in line with our syllabus. Of course, some lecturers are good, but a semester is short, and the students are supposed to

study six to seven courses in a semester. Then it becomes difficult to browse material from various sources and align all topics with the syllabus for study. Moreover, in-depth learning requires extra attention to understand the material taught in class.

d) The advancement of technology and availability of excess Google/YouTube topics of interest, to teachers and students, made this teaching and learning process more interesting and challenging. To address this, an instant messaging system, such as a WhatsApp group, are set up where students can freely post their questions directly to the instructor and/or among their peer group, resulting in less time spent searching on the internet.

e) Concepts in Biomedical Instrumentation (UBT532) combines four major units: Sensors, Biosensors, Ultrasonic, Optical & Laser biosensors, and Signal Processing. It is challenging to keep the class on the timeline and complete the syllabus on time with such variation in the course.

The following strategies have been implemented to improve the learning experience of the students.

a) Motivate the students by citing real-time applications of the topics covered in class whenever needed
b) Control the pace of the class as per the level of understanding. Indicating important points to remember which are prerequisites of other topics.
c) Stimulating interest in material uploaded on LMS for revision
d) Discuss the theory behind the laboratory experiment in lab class
e) A sincere effort has been made to synchronize the theory covered in a lecture class with the laboratory experiment to be performed in the lab
f) Think pair share activity was also introduced in one of the two-hour sessions during the semester

2.2 Challenges in online teaching

a) No eye contact
b) The remote location of the students
c) Connectivity issues
d) Hands-on experience in laboratories is missing
e) Sometimes a small topic takes a complete lecture
f) Limitations as regards large class assessment
g) Design of suitable assessment tools to monitor the effective learning of students

Here, I would like to mention that the approach in interventions was possible because of the following reasons:

a) My teaching experience and self-reflection
b) Basic and advanced CAPSL program
c) Virtual platform (LMS) and the software provided by our Institute during the pandemic
d) Developed technology-based multimedia platforms
e) Dynamic change in the teaching and learning process
f) Students-centered teaching process

3. Assessment strategies analysis:

The institute formulates a set of short descriptions and score-based questions to analyse and assess the quality of the interventions implemented. In the subject UBT508, the proposed interventions were used. Third-year UBT students were the intended audience. Sincere efforts were made to obtain unbiased feedback, and students were asked not to reveal their identities on the feedback form.

Student Feedback Form

Course: Concepts in Biomedical Instrumentation (UBT532)
Instructor Name: ----------

- What is your favourite aspect of this course? ……
- What aspects of the course would you like to change? …….
- What suggestions do you have for improving the instructor's teaching so that the syllabus can be completed on time? …….
- Whether the LMS lecture of the UBT 532 was properly structured? ----------
- Was the content effectively delivered during the lecture classes in online mode? -------
- Whether the course instructor was able to provide necessary instruction and feedback form time to time on LMS ----------
- Any activities that you enjoyed the most during online engagement of classes? ----------
- What are the instructor's strengths? ……

Rating on 1-5 scale: 1 - Poor, 2 - Satisfactory, 3 - Good, 4 - Very good, 5- Excellent

	Whether instructor encourages students to ask questions					
	Quality of the e-content shared on LMS					

	The instructor's important points to remember					
	Adjusts pace of class to the student's level of understanding					
	Stimulates interest in material uploaded on LMS					
	Explains the thinking behind statements					
	Whether the lecture aligned with lab					
	Entire syllabus coverage pace					
	Whether fair in the evaluation of exams					
	Overall satisfaction level					

Table 1 shows the percentage of 36 students with each score corresponding to the survey questions.

Table 1 - Percentage of students with each score corresponding to the survey questions

Question No.	Percentage of students in each score				
	1	2	3	4	5
1	0.00	3.33	2.33	11.25	83.09
2	0.96	5.27	12.42	13.33	65.02
3	2.28	2.50	11.32	19.05	64.85
4	2.28	7.50	11.32	11.05	67.85
5	0.00	1.70	13.52	19.20	65.58
6	2.12	3.20	6.67	11.01	77.00
7	10.00	3.33	6.67	16.67	63.33
8	7.25	5.27	11.20	10.25	66.03
9	3.25	7.50	9.32	14.05	65.88
10	2.28	7.50	11.32	11.05	67.85

For better analysis of the interventions, pictorial representations of the scores are presented in Fig.1 to Fig.10.

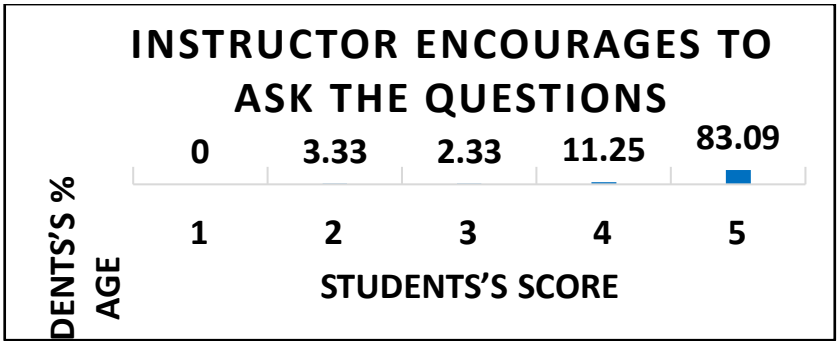


Figure.1: Instructor encourages students to ask questions

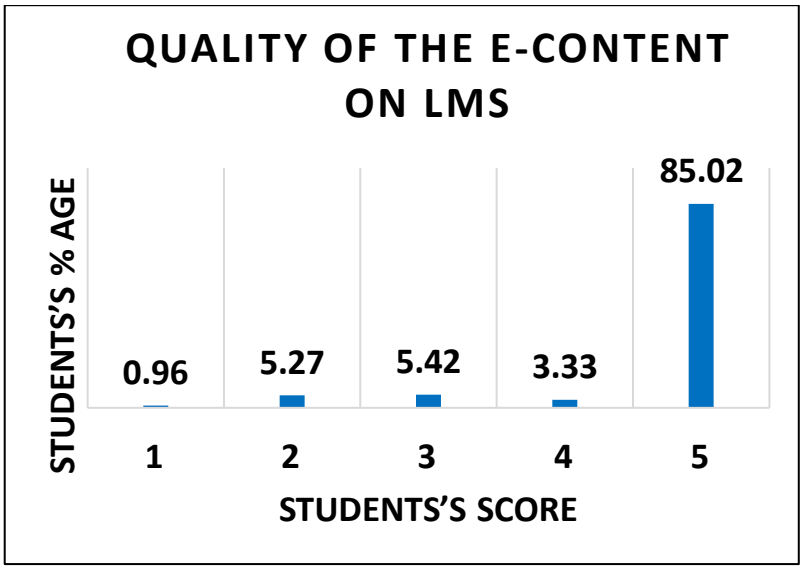


Figure.2: Quality of the e-content shared on LMS

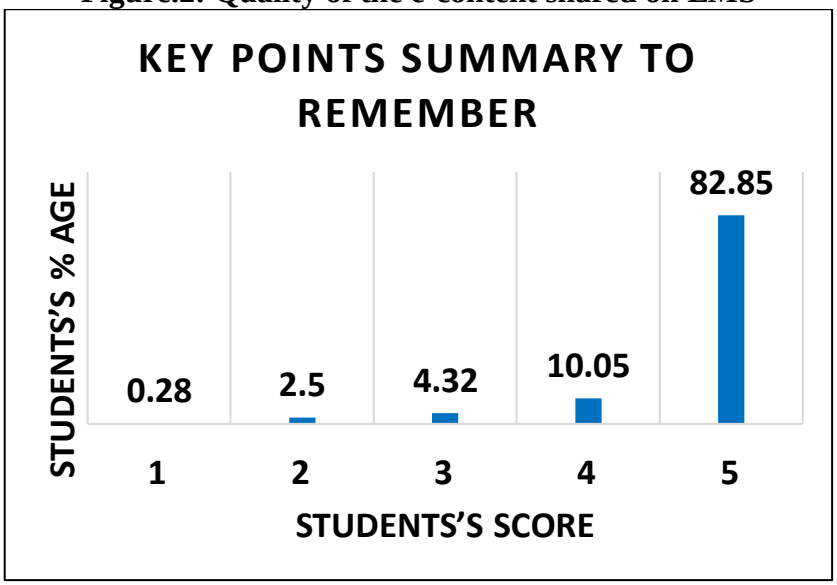


Figure.3: The instructor's important points to remember

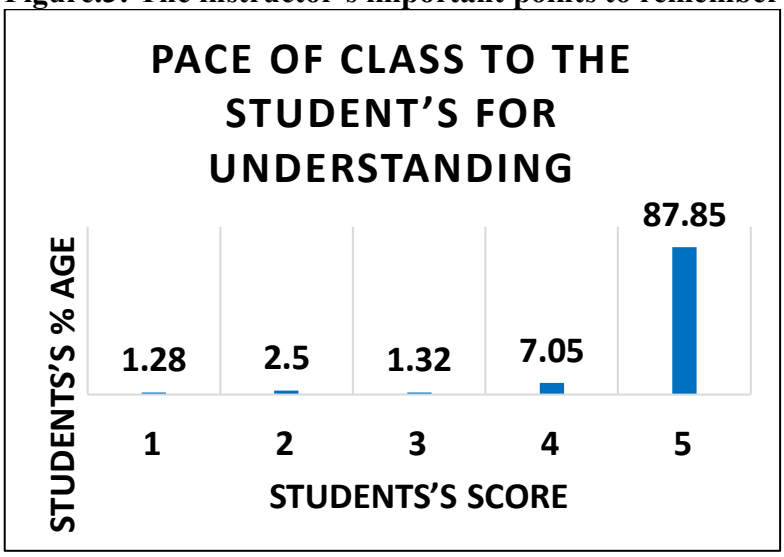


Figure.4: Adjusts pace of class to the student's level of understanding

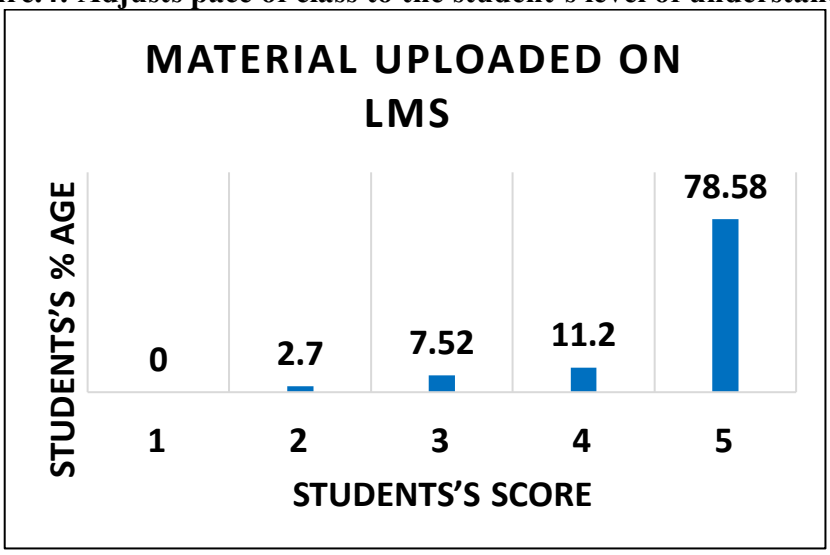


Figure.5: Stimulates interest in material uploaded on LMS

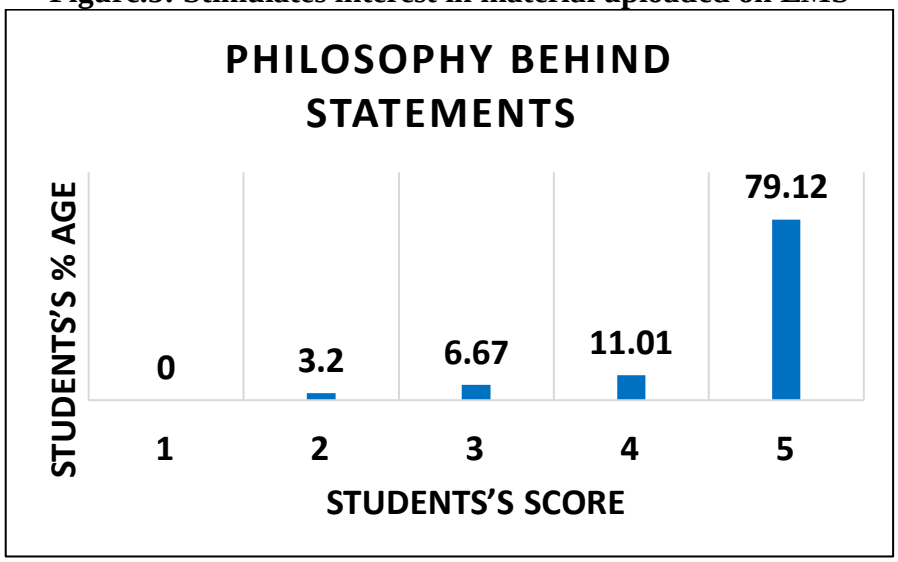


Figure.6: Explains the thinking behind statements

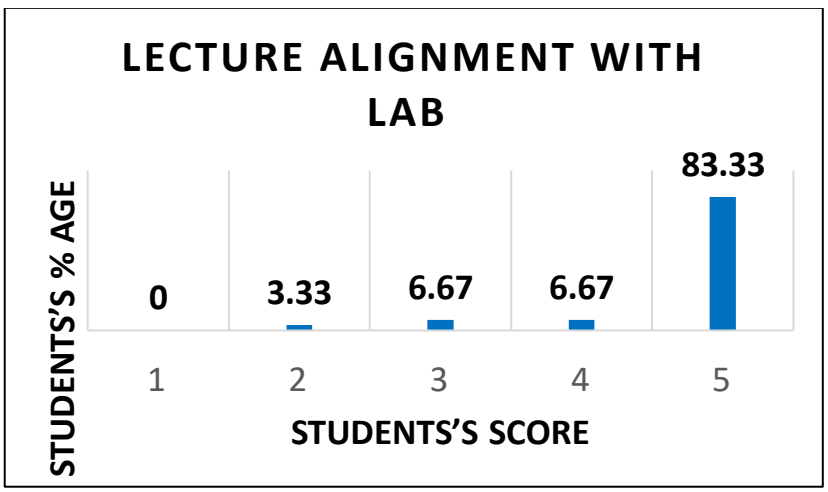


Figure.7: Lecture alignment with the laboratory experiments

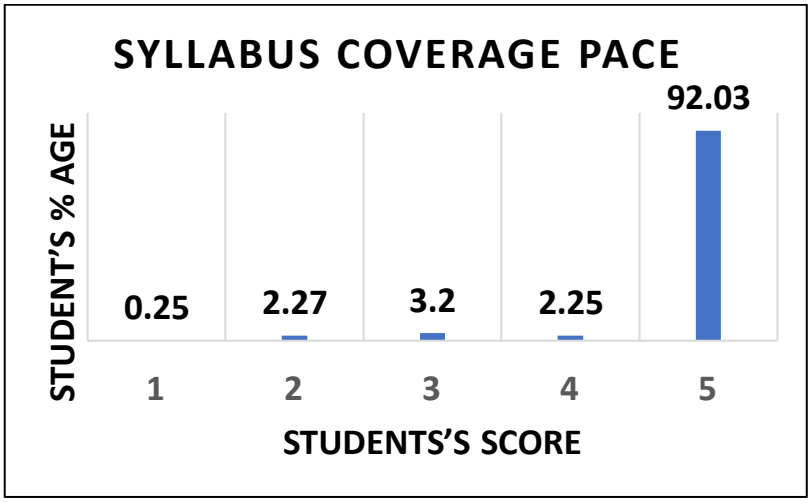


Figure.8: Entire syllabus coverage pace

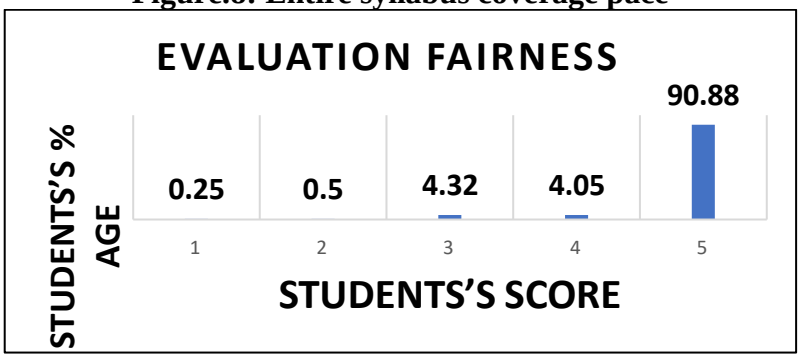


Figure.9: Fairness in the evaluation of the examination components

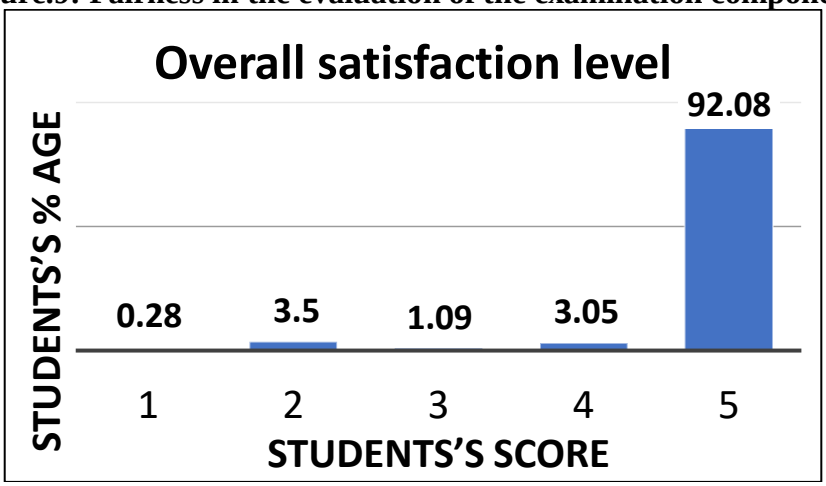
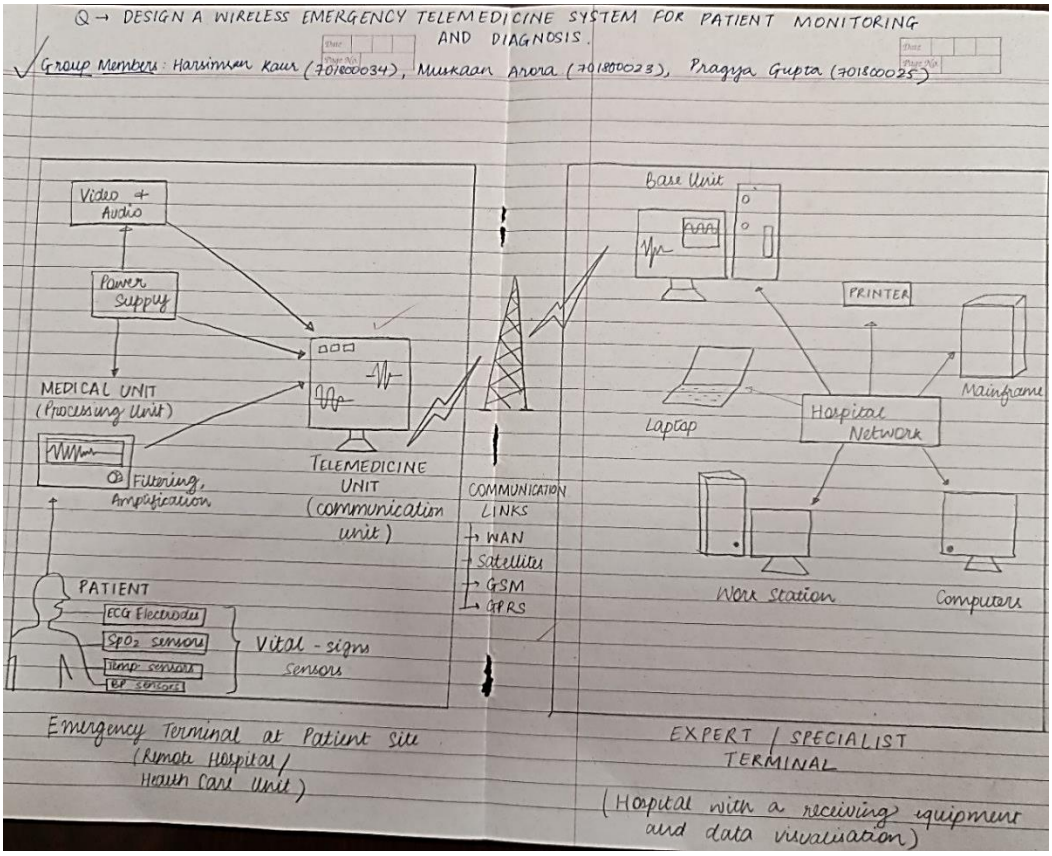


Figure.10: Overall satisfaction level of the course

Figure 11 shows the two sample copies of the two groups. All 36 students participated in this activity. Initially, students were grouped into 12 groups. This activity was very much appreciated by the students.



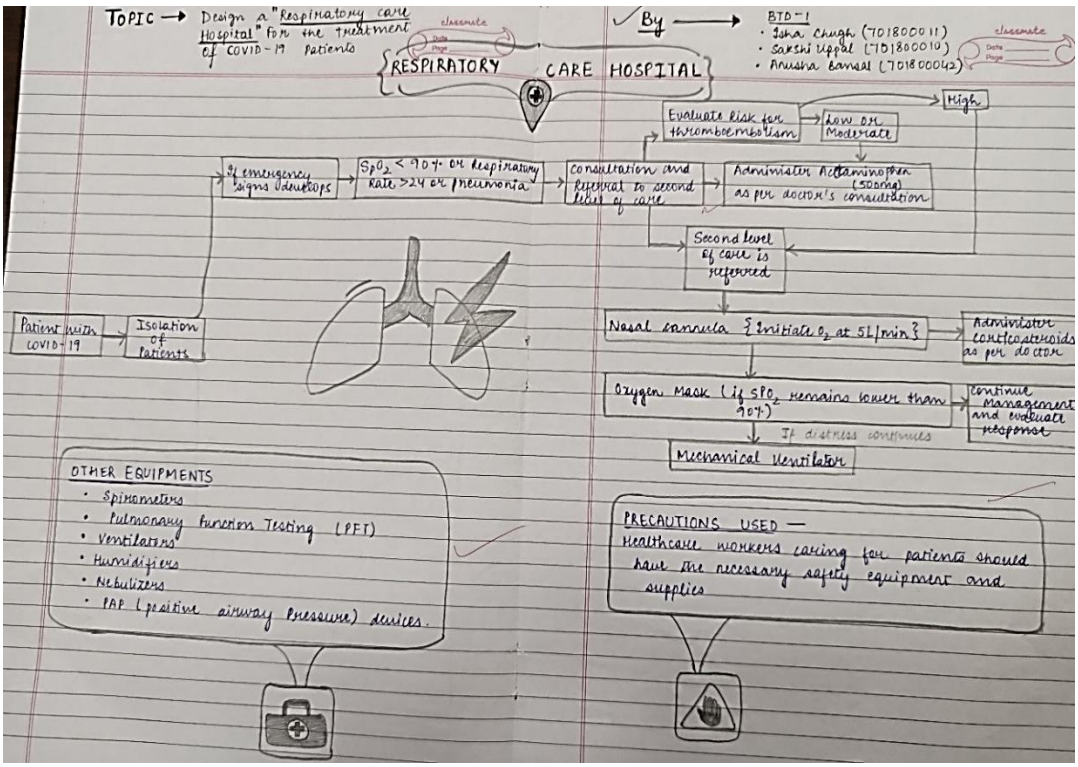


Fig.11 Think pair share samples of two groups

Student Feedback Form

Course: Concepts in Biomedical Instrumentation (UBT532)
Instructor Name: Dr. Ravinder Agarwal

- What is your favourite aspect of this course? Utilization of sensors on human body
- What aspects of the course would you like to change? Reduce the derivation part
- What suggestions do you have for improving the instructor's teaching so that the syllabus can be completed on time? .....
- Whether the LMS lecture of the UBT 532 was properly structured? ---Yes---
- Was the content effectively delivered during the lecture classes in online mode? ---Yes
- Whether the course instructor was able to provide necessary instruction and feedback form time to time on LMS ---Yes---
- Any activities that you enjoyed the most during online engagement of classes? Think Pair share Activity
- What are the instructor's strengths? Punctuality, Problem solving for students.

Rating on 1-5 scale: 1 - Poor, 2 - Satisfactory, 3 - Good, 4 - Very good, 5- Excellent

1.	Whether instructor encourages students to ask questions					✓
2.	Quality of the e-content shared on LMS					✓
3.	The instructor's important points to remember				✓	
4.	Adjusts pace of class to the student's level of understanding				✓	
5.	Stimulates interest in material uploaded on LMS					✓
6.	Explains the thinking behind statements					✓
7.	Whether the lecture aligned with the tutorial and lab				✓	
8.	Entire syllabus coverage pace			✓		
9.	Whether fair in the evaluation of exams				✓	
10.	Overall satisfaction level			✓		

Student Feedback Form

Course: Concepts in Biomedical Instrumentation (UBT532)
Instructor Name: Dr. Ravinder Agarwal

- What is your favourite aspect of this course? Use of sensors
- What aspects of the course would you like to change? Derivation part
- What suggestions do you have for improving the instructor's teaching so that the syllabus can be completed on time? library assignments
- Whether the LMS lecture of the UBT 532 was properly structured? ---yes---
- Was the content effectively delivered during the lecture classes in online mode? --yes
- Whether the course instructor was able to provide necessary instruction and feedback form time to time on LMS ---yes---
- Any activities that you enjoyed the most during online engagement of classes? ---TPS---
- What are the instructor's strengths? Regular behaviour

Rating on 1-5 scale: 1 - Poor, 2 - Satisfactory, 3 - Good, 4 - Very good, 5- Excellent

1.	Whether instructor encourages students to ask questions					✓
2.	Quality of the e-content shared on LMS					✓
3.	The instructor's important points to remember					✓
4.	Adjusts pace of class to the student's level of understanding					✓
5.	Stimulates interest in material uploaded on LMS					✓
6.	Explains the thinking behind statements					✓
7.	Whether the lecture aligned with lab				✓	
8.	Entire syllabus coverage pace				✓	
9.	Whether fair in the evaluation of exams					✓
10.	Overall satisfaction level					✓

Fig.12: Two sample sheets of the feedback

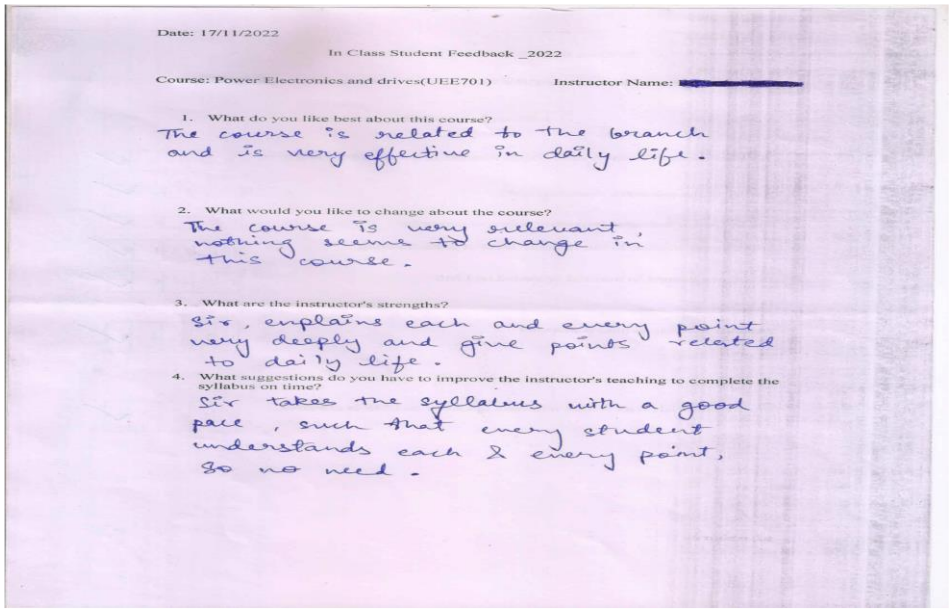
4. **Summary and conclusion:** This apaper discussed various interventions used to improve the learning experience of the students. Score-based questions are

prepared and framed to analyse the efficacy of the proposed interventions. Based on the questions given to the class students for feedback, it has been observed that the interventions are worthy of implementation for engagement and upliftment of knowledge of the students.

Annexure-1

T_1, represents the tutorial solved in class and Tute-01 represents the similar tutorial given to the students with hints and reference of the study material to be solved by their own effort.

Annexure-2



Date: 17/11/2022

In Class Student Feedback _2022

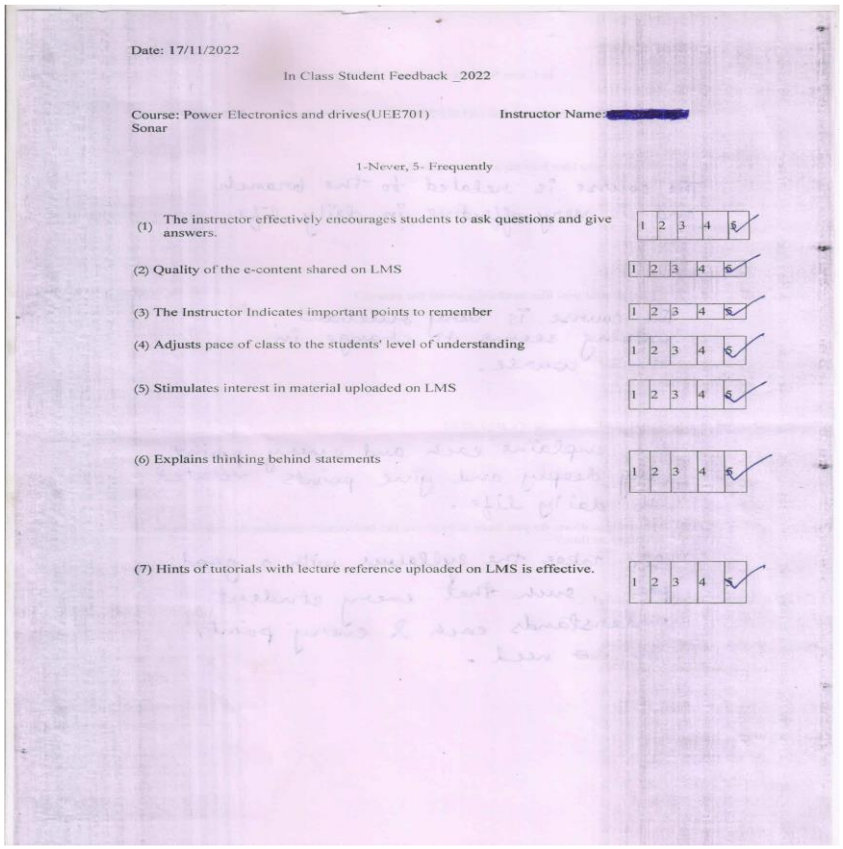
Course: Power Electronics and drives(UEE701) Instructor Name: [redacted]

1. What do you like best about this course?
The course is related to the branch and is very effective in daily life.

2. What would you like to change about the course?
The course is very relevant, nothing seems to change in this course.

3. What are the instructor's strengths?
Sir, explains each and every point very deeply and give points related to daily life.

4. What suggestions do you have to improve the instructor's teaching to complete the syllabus on time?
Sir takes the syllabus with a good pace, such that every student understands each & every point, so no need.



Date: 17/11/2022

In Class Student Feedback _2022

Course: Power Electronics and drives(UEE701) Instructor Name: [redacted] Sonar

1-Never, 5- Frequently

(1) The instructor effectively encourages students to ask questions and give answers. 1 2 3 4 5

(2) Quality of the e-content shared on LMS 1 2 3 4 5

(3) The Instructor Indicates important points to remember 1 2 3 4 5

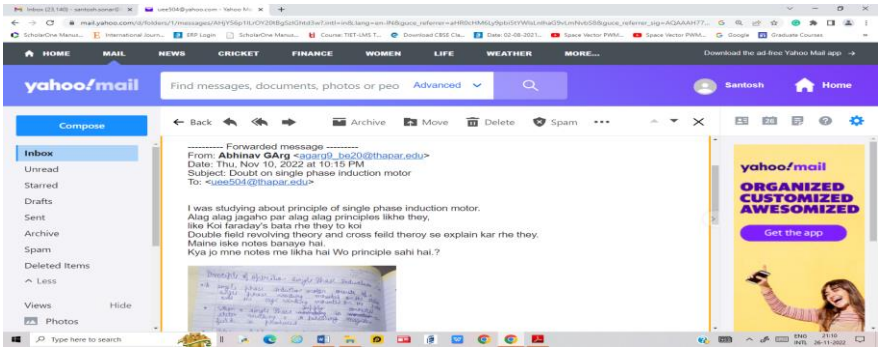
(4) Adjusts pace of class to the students' level of understanding 1 2 3 4 5

(5) Stimulates interest in material uploaded on LMS 1 2 3 4 5

(6) Explains thinking behind statements 1 2 3 4 5

(7) Hints of tutorials with lecture reference uploaded on LMS is effective. 1 2 3 4 5

Annexure-3



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