

An Adaptability of Online Engineering Education Amidst the COVID19 Pandemic

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Abstract— The COVID19 pandemic has disturbed the daily lives of people, including those in the education sector. It has tested the readiness of Higher Education Institutes (HEIs) and put in question the adaptability of students and faculty in using online teaching-learning modalities. This paper describes the development of an online engineering education in the department of Electronics and Telecommunication Engineering of Rajarambapu Institute of Technology, Islampur. The authors sampled 211 engineering students and 16 faculty members from the department of Electronics and Telecommunication Engineering using online survey forms. The author highlighted the requirements of online teaching-learning, the implementation methodology, online platforms, sample ICT tools and active learning tools used for the delivery of contents and conducting examinations. From the feedback of students and faculties members, it was found out that availability of resources, institute support, skill development and engagement have significant contribution to the adaptability of faculties and students to online teaching-learning. The pandemic situation has enhanced the adaptability of online teaching-learning during the COVID19 pandemic and also students and faculties are ready if any other similar man-made or natural disruptions occur.

Keywords— Online teaching-learning, ICT Tools, online platforms, adaptability, pandemic.

I. INTRODUCTION

THE COVID19 pandemic, which started in Wuhan, China in late 2019, is one of the deadliest catastrophes of the recent time. Inevitably, the pandemic has disrupted the daily lives of people including the higher education sector. To protect the health and safety of the public, countries around the world have implemented policies. Government of India issued series of circulars to guide entire education sector to implement online delivery using different information and communications technology (ICT) tools. It is a student centric and outcome-based education approach, for which its implementation depends on the availability of technology, availability of devices, internet connectivity. The online learning is the most ideal alternative of face-to-face learning and applies only if the technology readiness is high; learners have good digital devices, fast internet speed, and motivation to adapt to changes (Nikdel Teymori, 2022; J.R.Dhage et al., 2017; Mamta Meena, 2021).

The output of the study is the identification of requirements

and implementation methodology to the online engineering education while the main outcome is to find adaptability to online engineering education amongst students and faculties.

II. REQUIREMENTS

The students and faculties were motivated by conducting meetings. In the meeting, requirements and issues were gathered. For the effective delivery of online education, the requirements are devices (Smartphone/Laptop/Desktop), internet connectivity (wired/leased line/wireless/mobile data), average internet speed in Mbps, location, training, online platform, Learning Management System (LMS), social support, confidence, motivation. On the other hand, the demotivating factors were large screen time (4-5 hours a day), frequency of disruptions, lack of good internet speed, self-confidence, training, social support, lack of abilities to handle online platforms (Yadav, 2021).

III. IMPLEMENTATION METHODOLOGY

Most of the students had laptops/desktop and every student has smart phone with internet connectivity, however the speed of the internet was not sufficient especially in rural areas. To provide social support, meetings were conducted with parents. Mentors for group of students were appointed to motivate students in online mode. The students and faculties were trained to operate online platforms and most commonly used apps, time management, and perceived usefulness of online learning resources. Most commonly used platforms were Zoom, MS Teams, Google meet and Webex and apps are MS PPT, MS Excel, PDF Viewer. The ICT tools: online white board, Kahoot, Polly, Socrative, were used. Chat window was used to take feedback during live sessions of delivery and Google forms were used to take feedback at the end of completions of unit/chapter. Also online learning Massive Open Online Courses (MOOCs) and Open Educational Resources (OERs) were used (Kamerikar & Patil, 2020; Hew, 2014). Some sample ICT and active learning tools used are described here.

Kahoot quiz platform provides facility to create quiz including multiple choice questions, a true or false questions, and a single word response from each participant (Prabhavalikar & Patil, 2022). Since it displays leader board

after every question, it builds competitive spirit among students while solving quiz. This has provided engaging learning experience to the students. Figure 1 shows snapshot of quiz conduction using Kahoot while figure 2 depicts report after conduction of quiz.

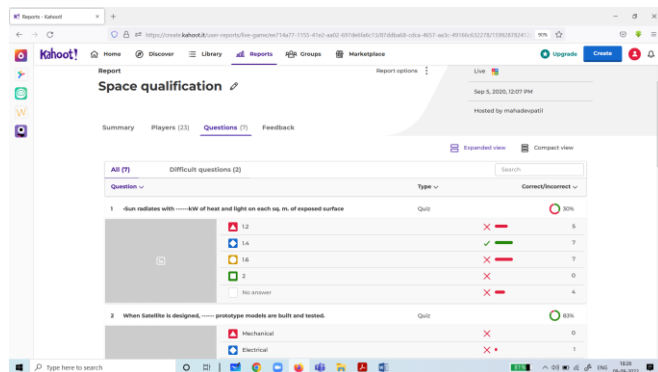


Fig. 1. Quiz conduction using Kahoot

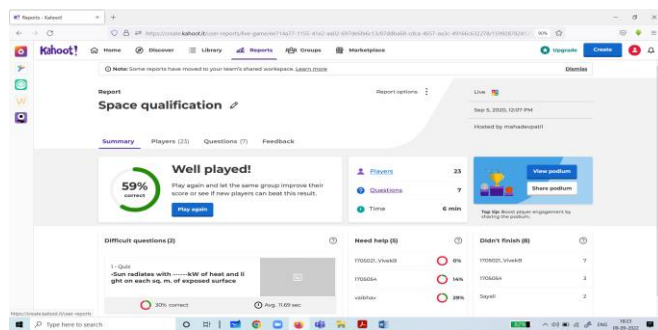


Fig. 2. Kahoot Quiz conduction report

Eclipse Crossword is another tool wherein it helped to focus on important concepts and keywords (Prabhavalikar & Patil, 2022). This was used to recall those keywords easily based on the hints given. Eclipse crossword runs on Windows operating system and one can download it from <https://www.eclips crossword.com/>. Once the software is downloaded, and after running the executable file, the platform is available to explore. It is open source software; freely available and user friendly. The activity helped in developing the habit to search for the word and in turn increased the vocabulary of students. Typical crossword puzzle is shown in figure 3.

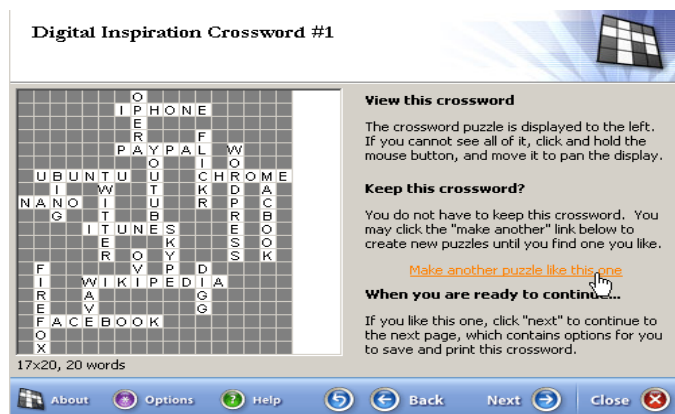


Fig. 3. Visual Layout of Puzzle

Flipped classroom active learning tool (M.S.Patil, 2020) using screen-o-matic has been used to learn and analyse the course material and communicate to the audience. Modular Object-Oriented Dynamic Learning Environment (MOODLE) is used to share the resources, Screen-o-matic is used to prepare videos (shown in figure 4) and MS Teams platform is used for online delivery (shown in figure 5). This has improved the interaction and communication skills of both students and faculties.

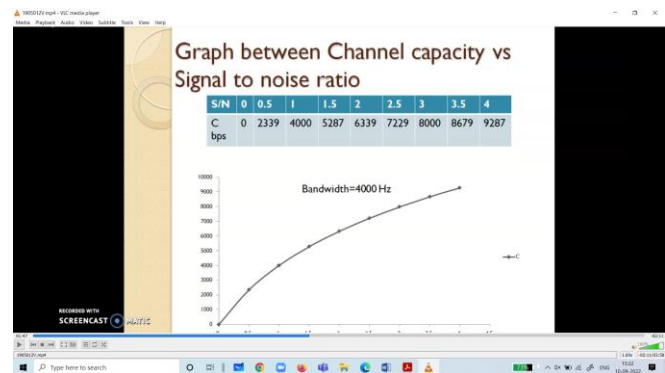


Fig. 4. Screenshot of video prepared by using Screen-o-matic

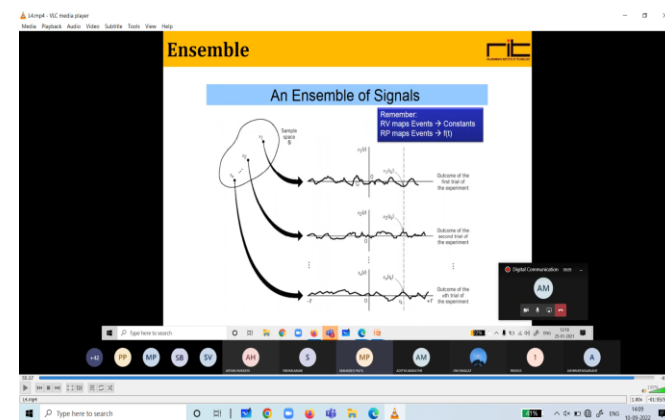


Fig. 5. Screenshot of MS Teams delivery platform

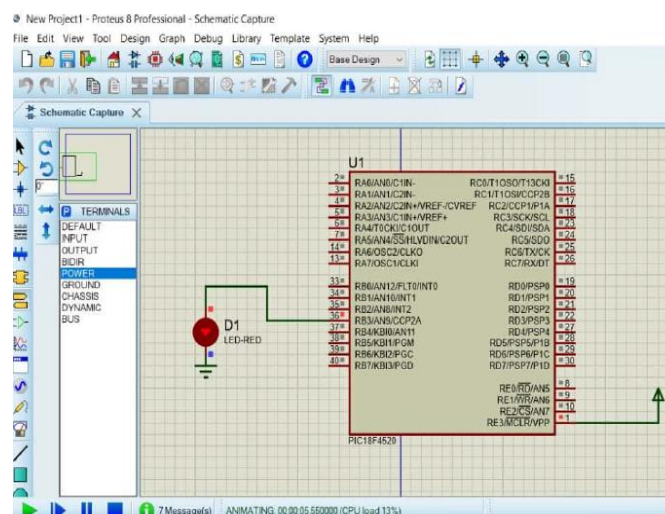


Fig. 6. Screenshot of MS Teams delivery platform

The project based learning (PBL) has been used using simulation software tools: MATLAB, SCILAB, Proteus and

Multisim (Patil & Kamerikar, 2020). Figure 6 shows screenshot of PIC Microcontroller circuit simulated in Proteus software (Kamerikar et al, 2020; Shet et al.,2017; Deepa et al., 2020).

In PBL, project statements are given by faculty and students come up with multiple solutions. Through the discussion, best solution is suggested to implement by faculty. The faculty mentors the students so as to reach completion stage. Every project is evaluated using rubrics.

The other available online active learning tools were also used such as Think share, Idea Spinner, Q & A in MS Chat, Polleverywhere (Refer figure 7), Cubing, Four Quadrants, Whip around, Socrative, ClassDojo (Refer figure 8) to promote students retention and engagement complying outcome based education. Current students are Z generation students possessing low attention time hence activity was changed every ten minutes. These virtual tools also provided a rich and joyful experience to students and helped them to retain the knowledge, upgrade the soft-skills as well as technical skills (Bhadri & Patil, 2022).



Fig. 7. Screenshot of Word cloud using Polleverywhere

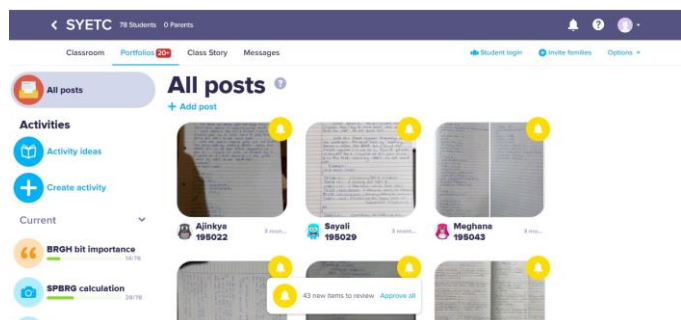


Fig. 8. Sample assignment upload in ClassDojo

The reports and assignments submitted by students are passed through Turnitin software for plagiarism check. Figure 9 shows screenshot of plagiarism report.

The institute self-developed named Enterprise Resource Planning (ERP) named RITAGE has been used to mark attendance whereas MOODLE has been used as Learning Management System (LMS) to share resources with students, conducting quizzes online, uploading assignments and question papers and answer books at the time of examinations (Horvat et al., 2015; Carla et al.,2016). Maharashtra Knowledge Corporation Limited (MKCL) platform was also used for conducting examinations. The laboratory experiments were performed by using virtual lab platforms of IITs, COEP and Campus wide license of MATLAB. The figure 10 shows the screenshot of MATLAB programming used for Analog

Communication laboratory whereas figure 11 shows screenshot of recorded video of experiment prepared for conduction of Power Electronics laboratory.

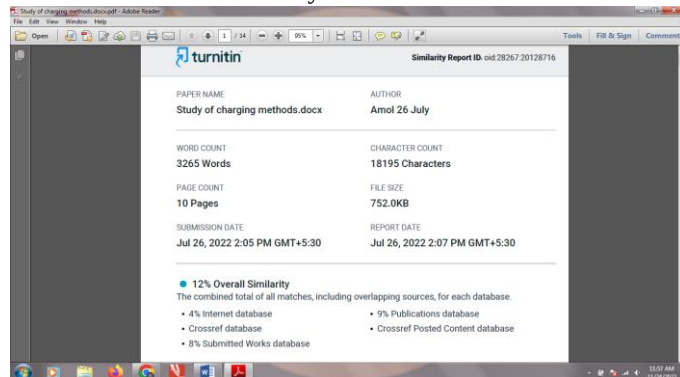


Fig. 9. Sample screenshot of plagiarism check

The course outcomes of experiments are mapped with program outcomes. The MS Excel spreadsheet is used for calculation of attainments of course outcomes and result analysis at the end of the semester.

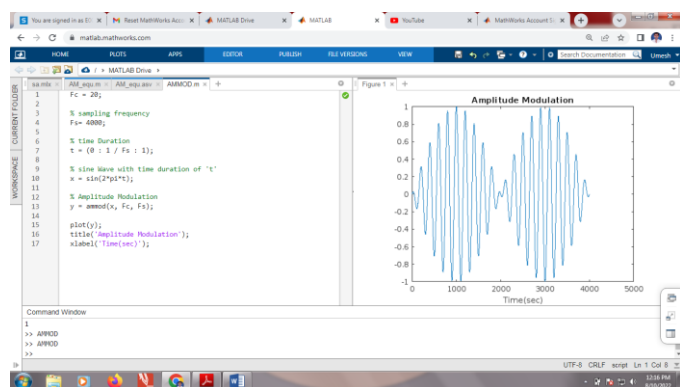


Fig. 10. Screenshot of MATLAB programming

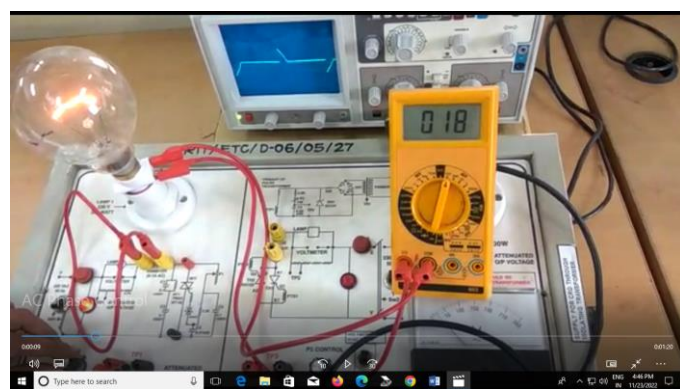


Fig. 11 Screenshot of demonstration video of experiment

The question papers were set using revised Bloom's Taxonomy levels. The online question paper consisted of application and case study oriented questions. To avoid malpractice, some data in numerical was provided through their roll numbers. Online examinations were conducted with the help of MKCL software by monitoring students through camera. Students were warned in case of misbehavior during exam. Slow learners and students with poor understanding were identified and remedial lectures were conducted for them.

IV. RESULTS AND DISCUSSION

The author utilized online survey questionnaires using Google Forms to gather the required data. Each form is composed of questions on levels of adaptation to online learning. In the form, the respondents were asked to answer a specific question to describe their percentage of adaptability to various components. Table I shows the adaptability of students to online learning with respect to resources required, institute support, participation, engagement and students' satisfaction. Though almost all the students had smart phones, few students had laptops or desktops. Moreover, the availability of high speed internet required for online learning process was not available with most of the students. The analysis is depicted in figure 12.

TABLE I.
ADAPTABILITY OF STUDENTS

Sr. No.	Questions	Response in %
Resources		
Q1	Are you able to operate laptop/desktop/mobile easily for online learning?	79
Q2	Up to what level you became familiar with ICT Tools?	83
Q3	Are you able to surf internet & use several applications for online teaching- learning process?	80
Q4	Have your parents encouraged to use the internet and laptop/desktop/mobile for learning purpose?	86
Q5	Do you had high speed Internet connection?	34
Resources Average		72.4
Institute support		
Q1	Are you satisfied with online teaching implemented by institute?	86
Q2	Have you obtained all learning resources from MOODLE LMS?	99
Q3	Have your professor provided resource material to learn independently?	95
Q4	Has your professor supportive on the use of online learning?	97
Institute support Average		94.25
Participation		
Q1	Had your peers collaborative in all online learning activities?	95
Q2	Did you had conducive environment for online learning?	72
Q3	Could you manage to stay focused despite disturbances like noise, social media etc.?	74
Q4	Did you able to communicate effectively using digital technologies?	86
Q5	Had you participated actively during online learning?	84
Participation average		82.2
Engagement		
Q1	Had you submitted all assignments in time?	80
Q2	Had you able to complete your online exams in time?	83
Q3	Are you able to manage time in all online learning classes?	79
Q4	Are you able to actively participate in online learning by managing screen time?	80
Engagement Average		80.5

Satisfaction		
Q1	Have you enjoyed and developed skills for online learning approach?	87
Q2	Whether you recommend such online learning in future at the time of natural disruptions?	96
Q3	Have you learnt and got knowledge of the courses taught online?	94
Satisfaction Average		92.33
Students' adaptability to online learning Average		84.34

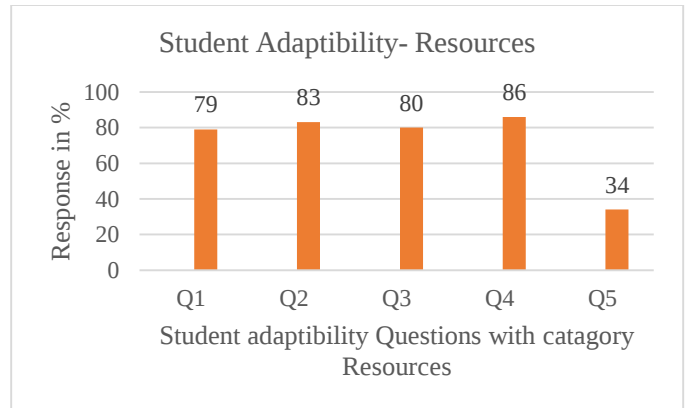


Fig. 12. Students' adaptability with respect to Resources

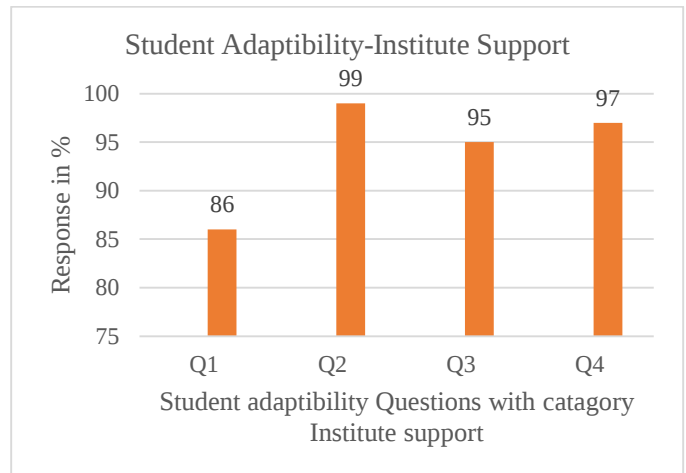


Fig. 13. Students' adaptability with respect to Institute support

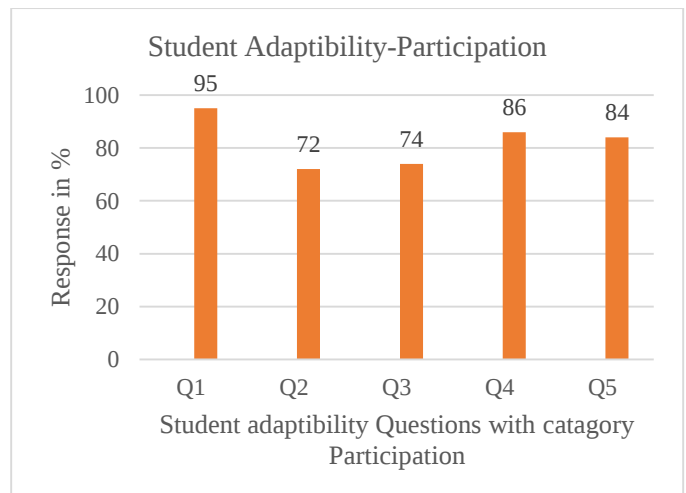


Fig. 14. Students' adaptability with respect to Participation

Figure 13 indicates that the institute has supported to fullest extent by providing all resources, training, motivation and LMS. Figure 14 shows the students participation, communication with peers and faculty. However, students had to manage with whatever environment they had in their homes for online learning and stay focused on learning despite disturbances. Figure 15 shows students' engagement in not only learning but also during online formative assessment and summative examinations. Students had tough time to manage screen time. However, figure 16 depicts students' satisfaction indicating they have developed skills for online education and agreed that education should be imparted using all available resources in such critical disruptions.

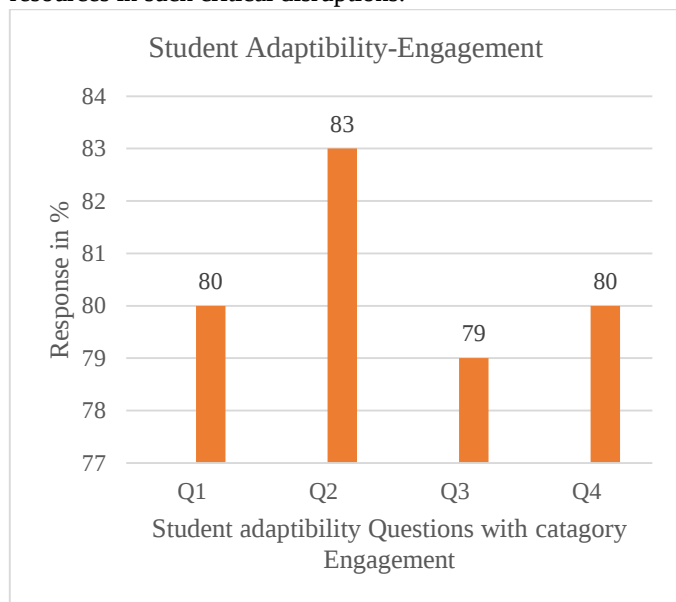


Fig. 15. Students' adaptability with respect to Engagement

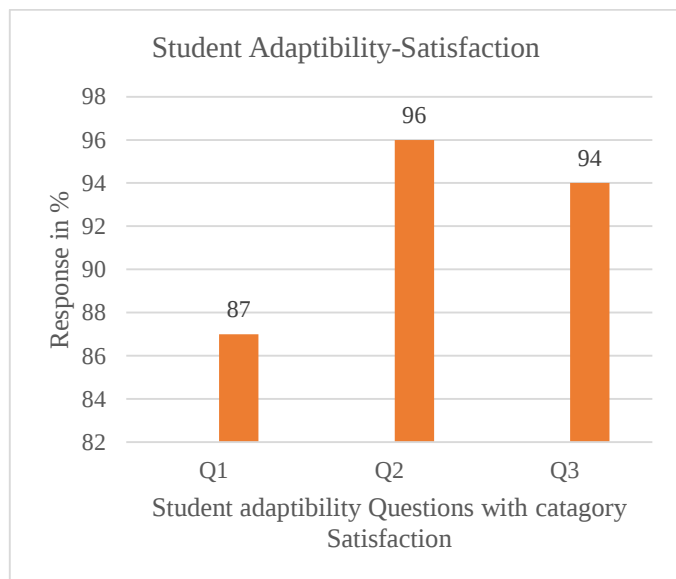


Fig. 16. Students' adaptability with respect to Satisfaction

TABLE II.
ADAPTABILITY OF FACULTIES

Sr. No.	Questions	Response in %
Resources		
1	Had you satisfied with your internet connection?	86
2	Did you had sufficient access to learning materials and resources?	88
3	Had your institute supported you with the required LMS and ICT resources?	93
4	Had your institute provided training prior to start of online teaching?	98
5	Did you have conducive space for online teaching in your home?	81
Resources Average		89.2
Skill development		
1	Have you received training for online teaching-learning process?	98
2	Have you developed skills to create & modify contents for online teaching?	94
3	Have you developed confidence to define online class of your own?	88
4	Are you able to operate all ICT tools?	86
5	Has online teaching enhanced your technical skill?	90
Skill development Average		91.2
Engagement		
1	Did you able to encourage active and participative learning among students?	94
2	Had your students interacted with you in chat box during online teaching?	84
3	Could you manage to stay focused despite disturbances like noise, social media etc.?	78
4	Did you able to communicate effectively using digital technologies with your students?	91
Engagement average		86.75
Time Management		
1	Had you managed time to deliver online teaching classes as scheduled?	80
2	Had you prepared sessions and learning material well before engaging?	95
3	Had you ensured that you had a work-life balance during online teaching?	79
4	Had you conducted formative and summative assessments in time?	87
Time Management Average		85.25
Satisfaction		
1	Have you enjoyed student teacher interaction?	96
2	Have you enjoyed and developed skills for online teaching?	92
3	Do you recommend online teaching in future in case of natural disruptions?	93
4	Have you accepted new normal in engineering education?	94
Satisfaction Average		93.75
Faculty members' adaptability to online teaching Average		89.23

Table II describes the adaptability of faculty members to online teaching with respect to resources, skill development, engagement, time management and satisfaction. The institute

provided training on online platforms initially on Zoom and then on MS Teams. The Faculty Development Program on use of ICT tools was extensively delivered to all the faculties. Senior faculties were handholded by junior faculties to solve their multimedia and technological problems. However, faculties had to manage with the location and space whatever they have in their homes. This analysis has been shown in figure 17. The figure 18 shows the Covid 19 pandemic has developed technical skills to create, modify and deliver e-contents. This has built the confidence of faculties. Figure 19 shows engagement of faculties in online teaching process where the response of staying focused on online teaching despite of disturbances due to noise, social media in this critical situation was difficult. Figure 20 depicts response of time management. Faculties could manage their activities in time since the time of travelling to institute was saved. Moreover, the work-life balance too was maintained. Faculties have enjoyed the online teaching since this was a new experience and had been implemented successfully by developing new skills. Figure 21 shows satisfaction of faculties obtained from online teaching-learning process.

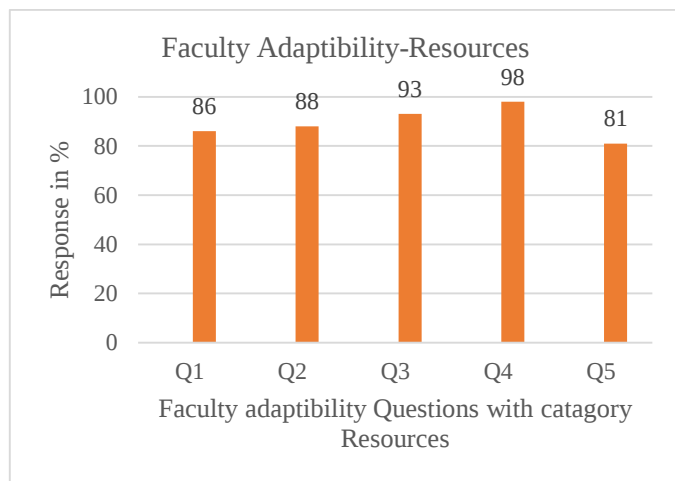


Fig. 17. Faculty members' adaptability with respect to Resources

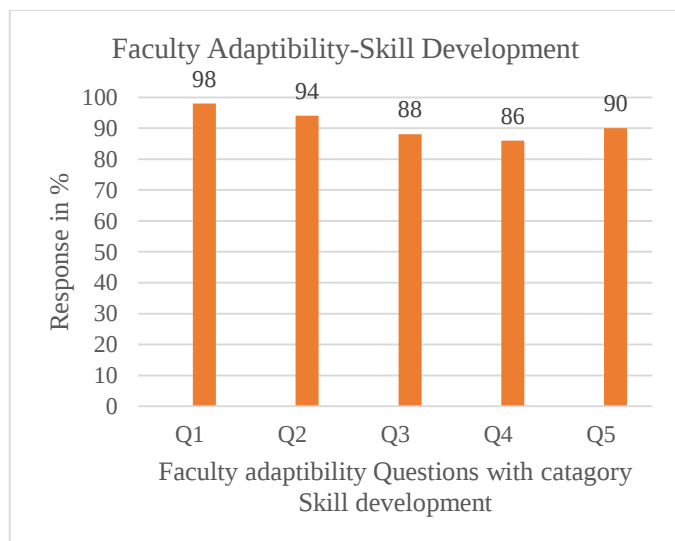


Fig. 18. Faculty members' adaptability with respect to Skill development

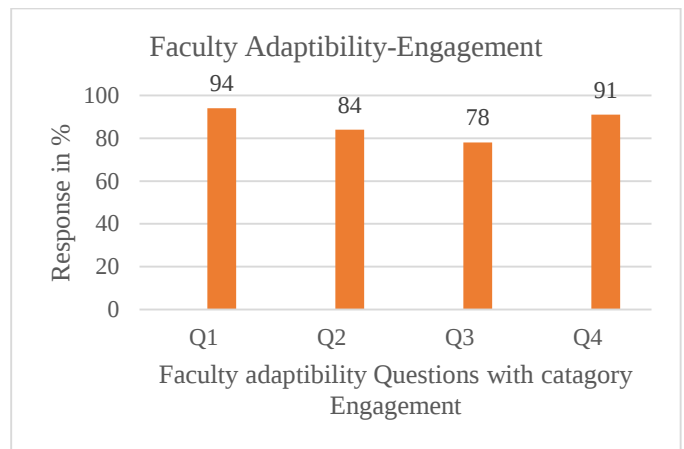


Fig. 19. Faculty members' adaptability with respect to Engagement

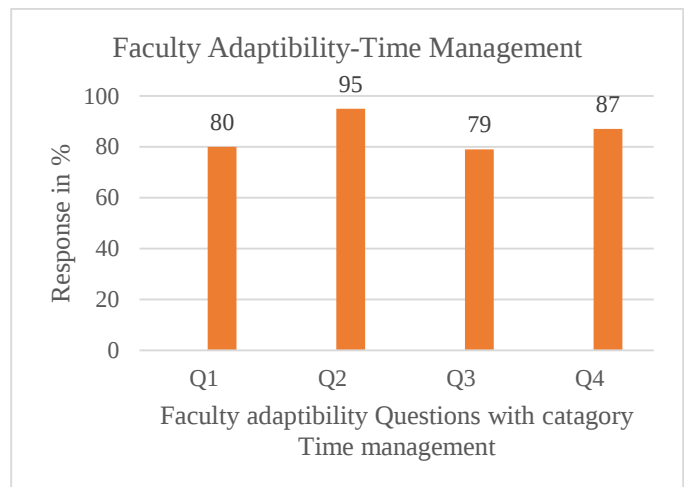


Fig. 20. Faculty members' adaptability with respect to Time management

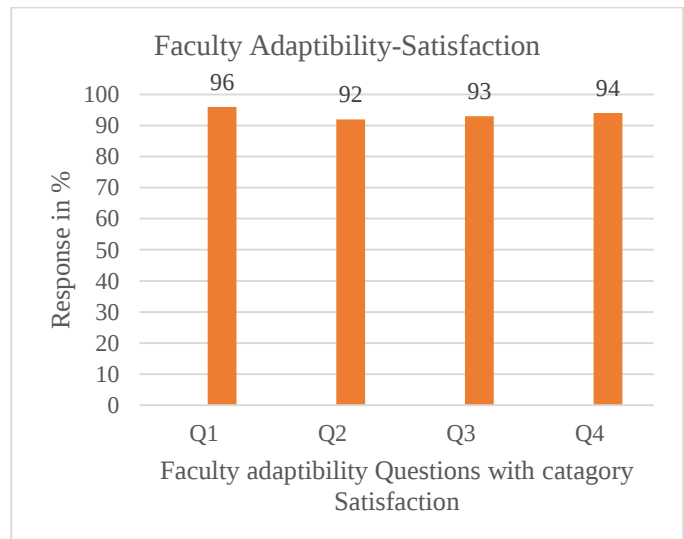


Fig. 21. Faculty members' adaptability with respect to Satisfaction

The average of Students' adaptability to online learning and average of faculty members' adaptability to online teaching have been plotted in figures 22 and 23 respectively. The analysis shows faculties have accepted new normal in engineering education. The joy of teaching-learning is the core

practice of institute and is achieved even in pandemic situation. Faculties have left no stone unturned while delivering online education and feels that in case of natural or artificial disruptions online teaching-learning process should be used to impart education.

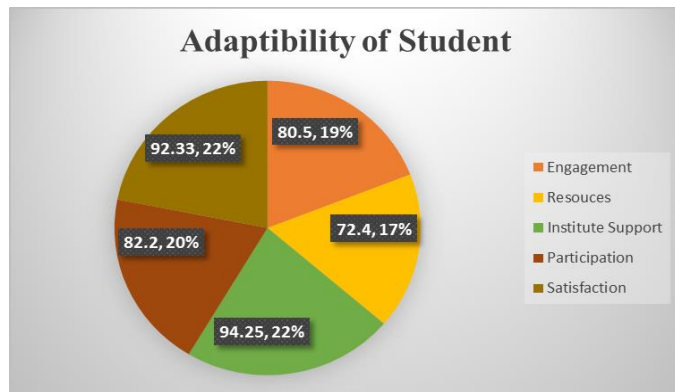


Fig. 22. Students' adaptability to online learning -Average

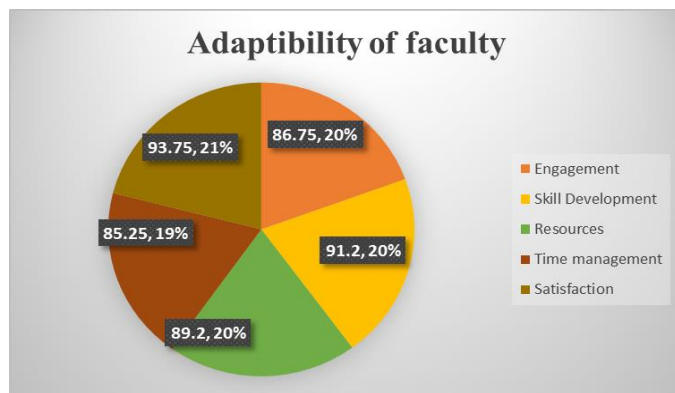


Fig. 23. Faculty members' adaptability to online teaching – Average

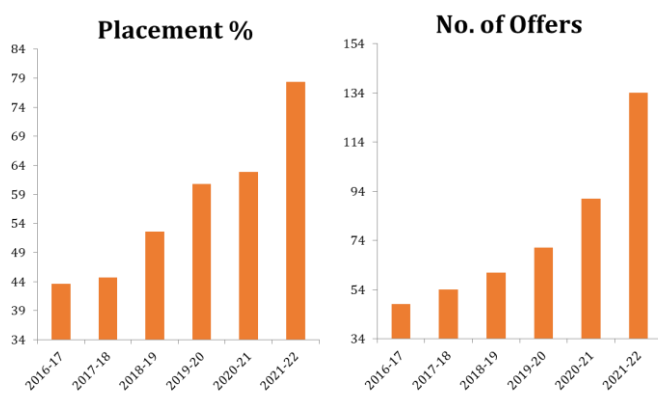


Fig. 24. Students' percentage of placement and placement offers

Despite of pandemic situation, due to online engineering education imparted, students have acquired digital literacy, use of online tools and platforms, online communication etiquettes, emotional intelligence and problem-solving skills required to perform job either in offline or online mode. The skills acquired by students during online teaching has resulted into placements and getting multiple offers from reputed companies. Figure 24 shows 82% students are placed in industry (remaining students opted for higher studies and start-ups) and 134 offers have been

offered to passing out 68 students of academic year 2021-22. Graphs show the rate of rise of placements and number of offers.

V. CONCLUSION

In the context of engineering education during the pandemic, the teacher-training and student training for the new normal, has focused on technological, online course content, instructional, evaluation and assessment knowledge empowerment. The COVID-19 pandemic has tremendously disrupted the activities of mankind. However, benefits offered by pandemic are the new skills developed among students and faculties, understood the importance of near and dear ones, importance of health and exercise, yoga and pranayama, importance of oxygen and unpolluted environment. Further some of the recommendations are to set up high speed internet connectivity even in rural areas, keep trained students and faculties on online tools and platforms even if pandemic is over. However due attention needs to be paid to screen-time. In terms of screen time, most students spend 4-6 hours, while faculties spent 4-5 hours per day. Meanwhile, the most-commonly used devices by the students and faculties are smartphones and laptops. They both connect through Wi-Fi at home, pay monthly internet bill of Rs. 300-400. Unfortunately, the students and faculties experienced 1-3 disruptions per day. The top 5 most commonly-used apps amongst students and faculties were MS PowerPoint, PDF Viewer, Zoom, Google Forms, Google meet, Google drive, MS Teams. While most of the respondents appreciated the good effects of online learning such as, convenience, savings on transportation costs, safety, work-life balance and efficient time management, however, they also raised key issues, as poor internet connection is the most pressing constraint and experienced social disconnect with peers. However, online education is preferred during natural as well as artificial disruptions since after all health is wealth.

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