Responding to COVID-19 and Transitioning to Online Learning: Evaluation of an Institution wide Capacity Building Efforts on Technology-Enhanced Learning

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Abstract: The usage of educational technology has steadily been increasing in engineering education in the last two decades. However, the impact of COVID-19 pandemic has truly led to a wider acceptance of educational technology due to the lockdowns imposed around the world. In India, the lockdown announced in the mid of the even semester forced all faculty to transition to an online mode of teaching. The sudden transition to online learning highlighted the unpreparedness of faculty and students towards their acceptance and usage of educational technology tools. To address this challenge and get faculty and students ready for the online mode of teaching and learning in the next semester, an extensive three-week faculty development program was conducted for all faculty at an undergraduate engineering college. The program included both synchronous and asynchronous sessions on the design of engineering courses through technology-enhanced learning. To get a student's preparedness for the transition, a 3-week orientation program was conducted prior to the start of the semester.

In this paper, the detailed process of the capacity building efforts and evaluate the impact of the programs on the faculty and students are presented. A pre-and post-survey was conducted to examine the challenges faced by faculty and students due to the sudden transition to online learning and also analyse the impact of the capacity building efforts on the teaching and learning process. The results from the study will highlight the process of an institution level preparedness efforts to respond to a pandemic and ensure the continuation of the academic activities. We discuss the implication of the results in the post COVID19 world where blended learning would become the default mode of education in higher education.

Keywords: COVID-19, Online teaching, Online learning, technology enhanced learning, FDP

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1. Introduction

The impact of COVID19 pandemic has deeply affected education across the world. The sudden outburst of the pandemic situation has challenged the delivery mode of education across the world as all schools and colleges were instructed to remain closed during the lockdowns. All educators were therefore forced to adopt an online mode of teaching to continue with their education process. The adoption of online learning required the educators to move away from their usual practice on in-person teaching and explore educational technology tools that they could utilize to support their teaching learning process. This paper describes a case-study of an institute wide capacity building effort that was taken up for faculty and students to help them during their transition to online learning.

The sudden announcement of nation-wide lockdown has witnessed a majority of educators to struggle while teaching online due to the lack of necessary training. In between the ongoing semester, all faculty in Indian higher education had to utilize various video conferencing platforms to complete teaching the courses and end the semester. The Center for Engineering Education Development (CEED) at KG Reddy College of Engineering recognized the need for training the faculty and organized a 3-week faculty development program to help faculty prepare to teach online in the subsequent semester. The training was taken up during the summer break when faculty had 6-week time to prepare for the upcoming semester. This paper details the capacity building programs along with detailed analysis of the evaluation of the efforts.

2. Literature Review

Studies in the existing literature demonstrated that there is an education emergency around the globe when the COVID19 pandemic impacted more than 180 countries. To promote social distancing, all the educational institutions had to be closed as the students and the staff were considered the source of transmitting the virus (Abdulamir et al., 2020). Many of the schools and higher educational engineering institutes have started to implement Interactive Video Conferencing (IVC) for teaching and learning online. IVC plays a significant role in supporting collaborative synchronous learning activities remotely (Anastasiades et al., 2010). Interaction, simulation, and collaboration enable

learning in the interactive environment (Thamarana, S., 2016). To make the learning more interactive, both theoretical and practical selection of the tools is considered to be important. Many of the researchers believe that the learning can become passive unless the instructors have required knowledge of the digital content and tools being used to facilitate student interaction. However, focussing merely on the technology does not serve the purpose and faculty will have to design their courses by understanding how technology is integrated with the content, pedagogy and assessments.

Majority of the institutions have started to utilize Learning Management Systems (LMS) as students' due to the lockdown had no access to the physical infrastructure such as library etc. The LMS provided students access to all the course content, learning resources, and access to instructor and peer feedback through discussion forums. However, despite the aforementioned benefits of LMS usage and ICT in general, many individuals have not yet adopted it completely in their teaching and learning process (Aljaloud, 2012). However, the shifting process is challenging due to the lack of training and technical assistance for the majority of the instructors as well as the learners while shifting to online mode of teaching. Hence the researchers believe that there is a need for additional academic training at their institutes because they are genuinely concerned about the quality of the online courses being delivered (Kumar et al., (2020); Allen & Seaman, 2008; Keengwe, Kidd, & Kyei-Blankson, 2009). For example, 920 students and 86 teachers at a private school were trained during the first week of the semester to use Google Hangouts Meet tools (Giorgi, 2020).

Based on the above research studies, the present article focuses on the preparedness of the faculty to teach online through the Technology-Enhanced Learning program at KG Reddy College of Engineering & Technology. This article also focuses on the training that was provided to the students on online learning through orientation program. Preparing faculty members to teach online would not only ease the course development process but also help them in delivering high- quality lectures, thereby creating a better learning experience for students. The purpose of this qualitative study was to investigate engineering faculty towards e-learning and to determine if faculty insights line up with current best practices for online education. The impact of the training provided was observed through the data collected in the form of pre-and post-survey instruments from both faculty and student's perspectives in the following areas.

A. *Access to the technology tools for online instructions:*
Selection of technology tools for delivering the lectures remotely in both synchronous and asynchronous play a crucial role during the transition to online learning. A variety of tools are available both in the form of open source and paid subscription. The institution has to take active steps to ensure that every faculty member has access to proper technology tools and connectivity.

B. *Live delivery of lectures and students' engagement:*
Many of the engineering institutions attempted to replicate the in-person classroom environment to a remote teaching environment online. In this situation, the quality of the live lectures becomes crucial in terms of effective delivery of the content and to ensure a meaningful and joyful experience for the learners. Most of the researchers agree that be it in a conventional or virtual classroom, student engagement defines the efficiency of the teaching and learning practices. Student engagement promotes the interest in the subject and creates curiosity while learning the concept. Student engagement activities like poll questions, public/private chats, random questioning through random generators, breakout rooms for collaborative activity, etc should be implemented in the live lectures.

C. *Managing the digital content through LMSs:*
Digital learning material aids the learning for the students which helps them to self-regulate their learning. The instructors should provide a platform to access the learning materials through a repository for the students. Learning Management System can be used as a course website to publish all the digital learning materials in multiple formats. Flipped classroom techniques could be effectively implemented through the LMS. Institution could train faculty to use the software required for efficient online delivery of courses through a robust LMS and also design, implement and administer both formative and summative assessments through the LMS.

D. *Design and implementing of online assessments:*
Designing and implementing the assessments are an essential part of the teaching-learning process and are not just grades. It gives both the teachers and students an update about their progress in meeting learning outcomes of the course through the data collected from student examinations, discussion, and other tasks. Formative assessments represent a shift from grading to growing (Calfee et al., 2014). It provides information about what students know well and what they need to continue to learn. With appropriate scaffolding from faculty, students not only learn more cognitive skills but also learn how to transfer their knowledge to higher-order learning. During the Covid-19 emergency shift, the majority of the faculty members have transit themselves to remote teaching but faced a challenge in design and implementing the assessments online.

3. Methodology

A study was conducted using pre-and post-surveys to investigate the perception of online teaching & learning and evaluate the same after the training programs. The flowchart in Fig.1 represents the framework of the research survey conducted to evaluate faculty and students transition to online learning. A pre-survey was conducted to identify the challenges encountered by faculty and students' due to the switch to online learning in mid of the semester. The post-survey was conducted during the new semester to analyse if the capacity building efforts helped faculty and students to overcome their challenges with online teaching learning. Two survey instruments have been developed and disseminated to both the faculty and students. A total of 258 students and 33 faculty have participated in the pre-survey and 233 students and a 52 faculty in the post-survey.
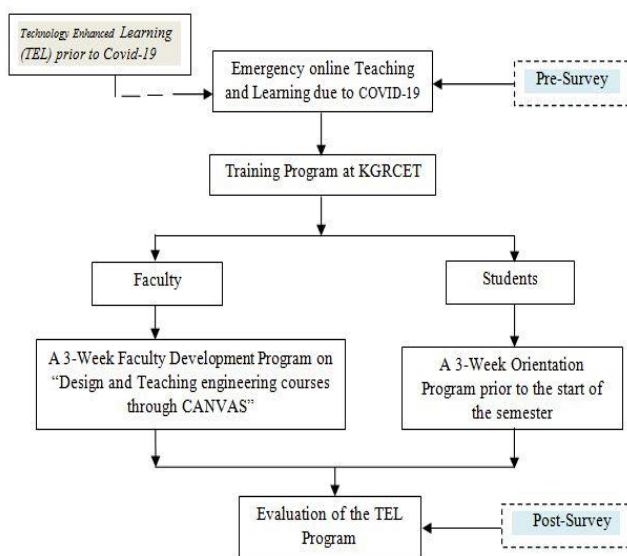
Fig.1 Framework of the research

3.1 Pre-Survey: The data received from 258 faculty and 33 students were collated and analysed to understand the various aspects of emergency remote teaching and learning. Google forms have been used to create survey instruments. Several key findings obtained from the pre-survey are presented below:

- Around 90.1% of the faculty taught and 82.17% of the students were using an online mode of teaching for the first time. This showed that there was a need to build awareness among them to adapt to remote teaching and learning strategies on an emergency basis.
- The survey showed instructors used multiple platforms for video conferencing and teaching their courses. 68% of students said they took online classes through platforms like Zoomand22.8% CANVAS, GoogleMeet, and WebEx. The point to be noted here was that due to

multiple applications being used, student had to keep switching to the different applications for different courses.

- 84.8% of the faculty said that they were using LMS but only 74% of students are aware that they have LMS.
- One-third of faculty said they won't use pre-recorded lectures while others said they recorded and uploaded them on YouTube. Effective use of LMS could be the best solution to bring all the content into a single repository.
- Only 27% of faculty and 3.5% of the students interacted through the course website outside of the online class. Majority of the students said that the interaction outside of the classroom happened through WhatsApp.
- A common challenge for both faculty and students was internet and bandwidth issues. This has majorly impacted the quality of the synchronous classes. The use of LMS could address this issue as the faculty had the option to record the session and later publish it on their course websites.
- 33% of the students say there was no provision for the access of learning materials while only 30% said the learning materials were uploaded in Course Websites. Rest of the students accessed the learning resources through the links uploaded in YouTube, Google Drives, etc.

To address the above challenges, training on technology-enhance learning was facilitated for both the faculty and students. A 3-week faculty development program on "Design and Teaching of Engineering Courses through CANVAS Learning Management System" was conducted for faculty and a 3-week "orientation program" has been carried out to the students prior to the start of the semester.

3.2 Training on Technology-Enhanced Learning

3.2.1 Training for Faculty:

The 3-week faculty development program was aimed to help the faculty understand the alignment of educational technology tools to their content, assessment, and pedagogy. The FDP started with 3-daysof synchronous session followed by 2-week asynchronous sessions and ended with 2-day synchronous virtual faculty conclave. A total of 60 faculty participated in the program from various specializations.

The outcomes of 3-week training program are:
1. Design a T-CAP model for a module of a course to be taught in the upcoming semester.
2. Design a course website to teach the courses allotted in

the upcoming semester.
3. Design assessments and provide constructive feedback with systematic analysis
4. Plan and implement constructive and interactive teaching learning experiences
5. Select appropriate educational technology tools that support content, assessment, and pedagogy.

During the 3-day synchronous sessions conducted in virtual mode, faculty were trained on various topics as mentioned below:

(i) Technology and education: The importance of the technology in engineering education and the educational technology tools being used for an asynchronous & synchronous mode of instructions were delivered.

(ii) Focus on content & technology: Methods to teach different content types i.e. facts, concepts, processes, procedures, and principles were demonstrated with examples along with the mapping of contents to the appropriate instructional methods. Faculty later explored various technology tools to represent the content for their courses.

(iii) Focus on assessment & technology: Both the formative and summative assessments were presented along with an exploration of technology tools required to design, implement and administer the assessments. Faculty were provided with practice sessions to understand how both formative and summative assessments could be administered through the Canvas LMS.

(iv)Focus on pedagogy & technology: The ICAP principles for active student engagement activities were explored in this session. Demonstrations were given for both the synchronous and asynchronous modes using various education technology tools available in the Canvas LMS.

(v) Constructive alignment of T-CAP: The faculty were then encouraged to think about the alignment of the educational tools they're using to the content, assessment, and pedagogy of the course. The participants were made to reflect on how the four elements of the T-CAP model (shown in Fig. 2) were constructively aligned for their respective courses.
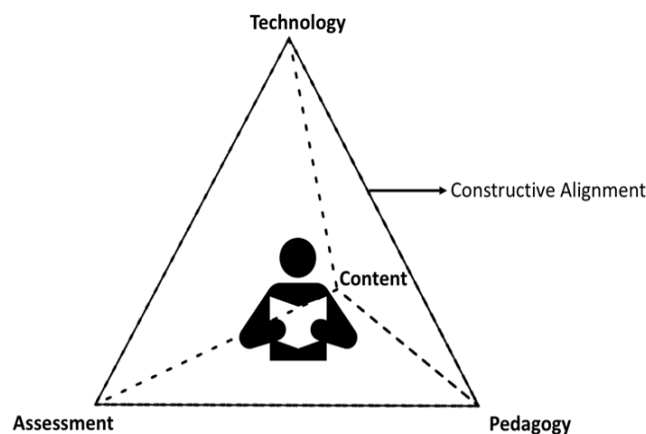

Fig.2 Constructive alignment using T-CAP

A hands-on session using CANVAS learning management system was carried out during all the sessions. The sessions were live through the CANVAS platform. Though the sessions are in virtual mode the faculty were kept engaged in the program through Poll questions, instant assessments through random number generator and workbooks. The faculty had also an opportunity to work in pairs through the Think-pair-Share activity conducted virtually. This happened by giving identification numbers to the pair of faculty and asking them to respond through random number generators. The participants had shared their responses using public/private chat, enabling microphones and/or sharing their respective screens. After the session, the participants were given a chance to discuss and clarify the doubts on submitting the worksheet activities in the canvas

Learning Outcomes (LO)	Relevant Topic	Assessment	Pedagogy
Perform the testing on the DC Machines	Applied to the difficulty concept (Retardation Test).	The student has to practically demonstrate in the laboratory or through virtual mode	The students watch the video and a discussion in the classroom through the grouping of students.
Technology	Through flipped class approach a video about the experimental procedure and finding inertia constant is posted through canvas.	Virtual Lab Demonstration	Students can clarify about the difficulty concept through discussions In The Canvas

discussion forum. At the end of the session, the faculty were made to highlight the constructive alignment between T-CAP for one of the learning outcome as shown in the below Table 1.

Table 1. Check for alignment of T-CAP

After the first week of the training program, feedback was given to the faculty on developing the course websites as per the quality criteria for content uploading, quality of the learning materials uploaded, designing and administering the assessments, and delivery of the course content. Quality criteria for publishing the content and designing the assessments in the canvas LMS has been developed to maintain uniformity in creating digital content for all the course owners.

In the last phase, a virtual faculty conclave was conducted in the third week where the faculty showcased their practices of developing course websites and its effective implementation including managing the learning content, designing and administrating the assessments along with student engagement activities online. A screenshot of the presentation is shown in Fig.2.1.
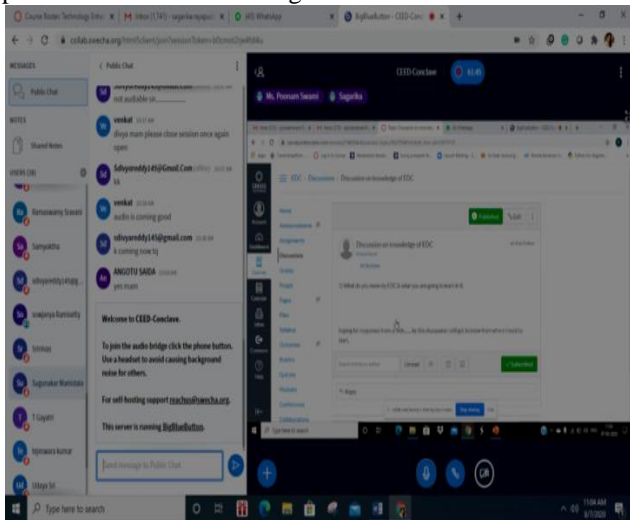

Fig.2.1 Demonstration through CANVAS in Virtual faculty conclave

3.2.2 Training for Students:

A 3-week orientation program was conducted for the students prior to the start of the semester to get them acquainted with online teaching and learning practices. A total of 350 students participated in the program. Sessions on introducing the Learning managements system using CANVAS, getting engaged in the live video conferencing through hands-on sessions was the major focus area during the orientation program. The students were introduced to the New Age Engineering approach through the virtual session by adapting the emerging. A screenshot of the session is shown in Fig.3.Various student engagement activities like online assessments using the LMS, participating in discussions, accessing the learning materials published in course websites were practiced by the students during the orientation program.
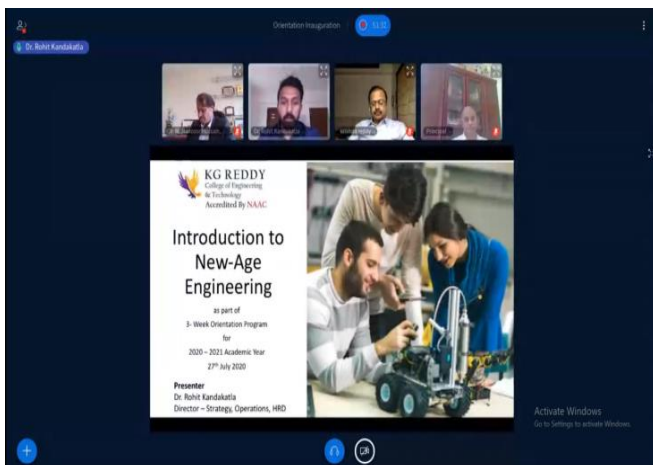

Fig.3 Screenshots showing the orientation program for students

3.3 Post Survey

A total of 233 students and 52 faculty have participated in the post survey conducted through Google forms. Below are the few observations received in various areas mentioned as an outcome of the training program.

3.3.1 Access to the technology tools for online instruction

The use of technology tools for remote lecture delivery both in synchronous and asynchronous modes played a crucial role in the sudden transition. The post-survey results showed 96.2% of faculty using CANVAS platform for lecture delivery, as indicated in Figure 4 and 94% of students said they took lectures through CANVAS as shown in Fig.5. From Fig. 6, 48.1% of the faculty were comfortable to manage the course content and teach through the LMS and 42.3% were good to manage their course content and teach through the LMS. From the students' point of view, 42.1% of students are comfortable with the LMS being used, 37.8% gave a neutral reply to their usage of the LMS.
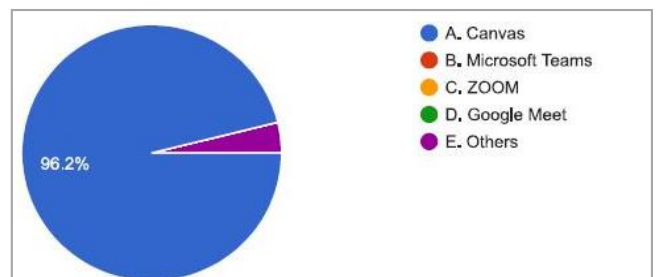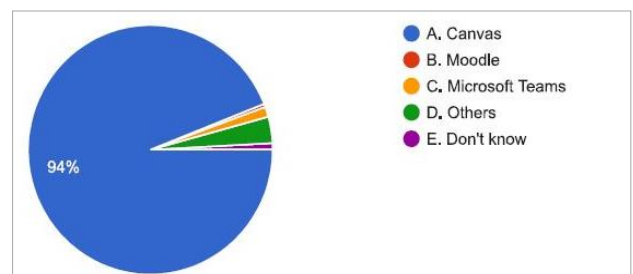

Fig.4 Video conferencing tool used to teach courses

Fig.5 LMS used for managing the course

3.3.2 Live delivery of lectures and students engagement

After the training program, 90.4% of faculty felt confident of using live lectures as observed in Fig.6. The post survey showed that nearly 80% of the students were satisfied with the quality of live lecture by giving response excellent, good & fair. Engaging students through online teaching played an important role in improving student's interest in concepts online. In the survey, around 51.9% of the students felt that the faculty were able to engage them during the online classes through activities and 92.3% of

the faculty indicated they were engaging the students during the online interaction through a microphone which is observed from the responses shown in Fig.8 & Fig.9
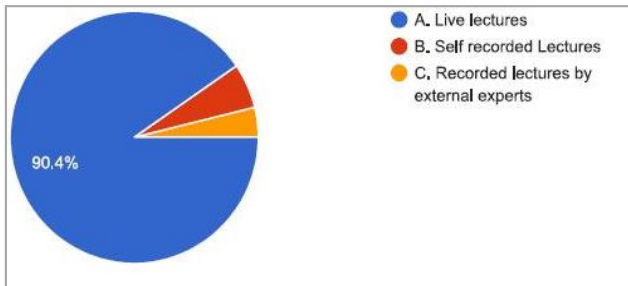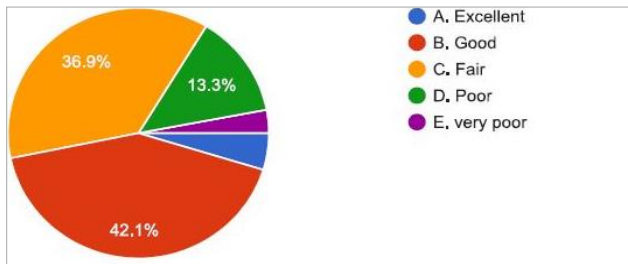

Fig.6 Delivery mode used teach online
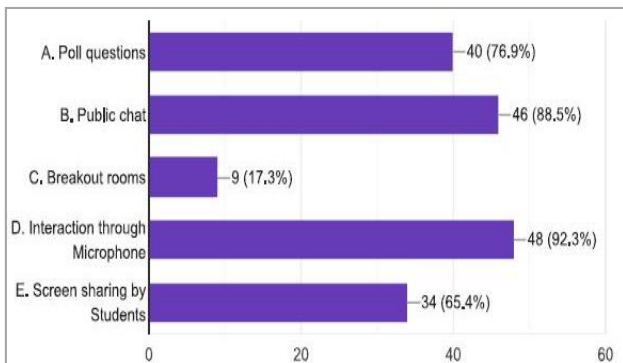

Fig.7 Students: Quality of Live Lectures?
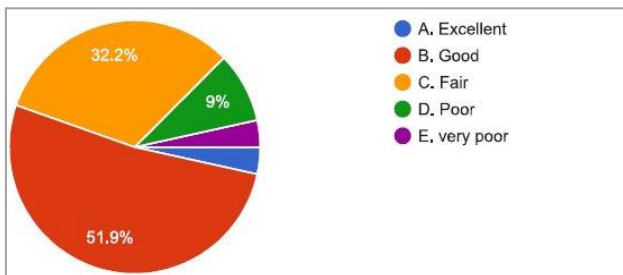

Fig. 8 Student engagement during online classes

Fig.9 Responses to student engagement during online classes

3.3.3 Managing the digital content through LMSs

Post Survey showed that nearly 82.7% of the faculty members took pre-recorded lectures and published them in CANVAS LMS (Fig.10). According to the post-survey 81% of students rated the quality of the pre-recorded lectures to be good & fair (Fig.11). The learning materials used in the online mode have to be different from the ones used in the regular face-to-face classes. All learning materials have

also been digitized for uploading. From Figure 12 responses, faculty showed that 100% of the faculty able to upload and manage the digital content using a single LMS (CANVAS). Fig.13 showed that 74.2% of the students responded that they accessed the lecture materials from content uploaded on CANVAS LMS.
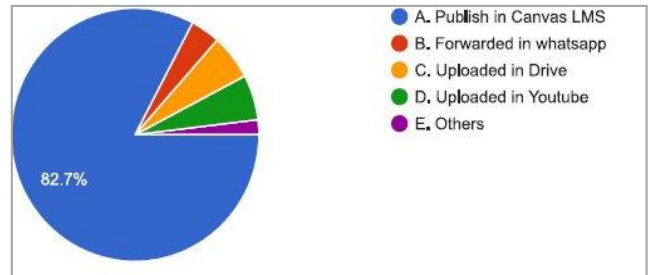

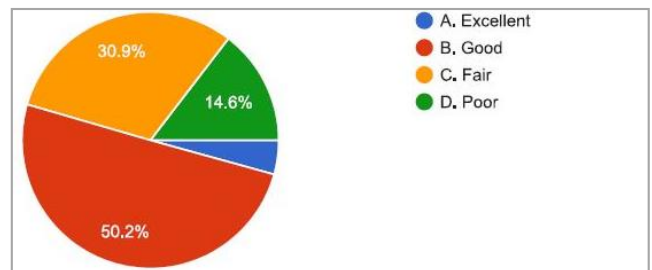Fig.10 How do you use the pre-recorded lectures?

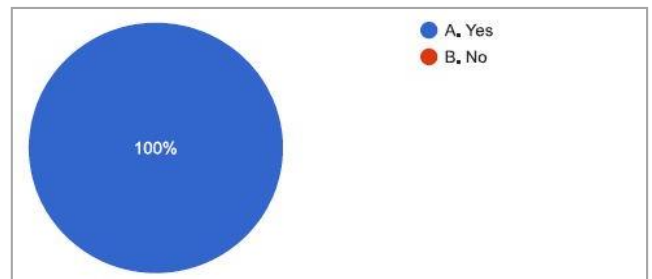Fig.11 How would you rate the quality of the pre-recorded lectures?

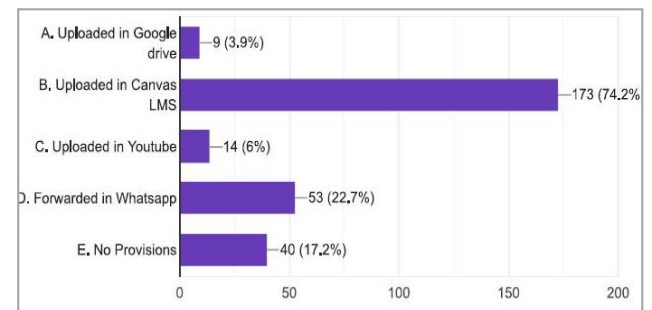Fig.12 Manage digital content using a single LMS tool

Fig.13 Provisions to access the lecture materials if you miss classes?

3.3.4 Design and implementing online assessments

Nearly 96.2 %of faculty said that they had made use of quizzes as formative assessment, 82.7% of faculty used descriptive assignments to be submitted online, and 23.1% of faculty used group discussion as another form of assessments (Fig.14). A lot of confidence has been built among the faculty to design, implement and administer the

assessments online and the same was reflected in their responses as shown in Fig.15, where faculty said they were able to conduct summative assessments online.
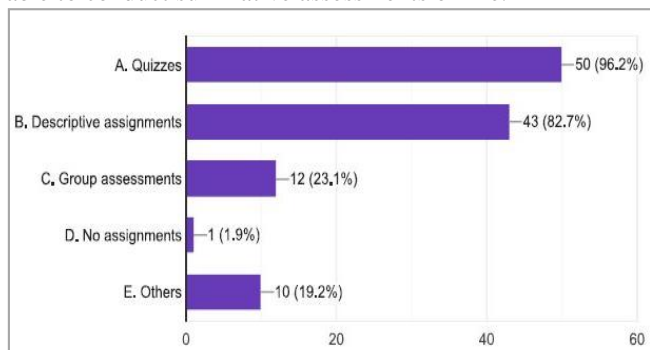

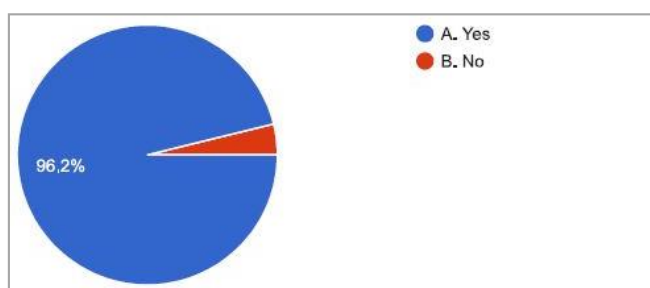Fig. 14 Types of assessment used in online class

Fig.15 Confidence to conduct summative assessments online

4. Results &Discussion

The pre-survey allowed this research to identify the challenges faced by both the instructors and students when they had to suddenly transition to online mode of teaching and learning. The post-survey responses collected after technology-enhanced learning programs showed results in terms of the improvements that happened. The analysis made from both the pre-and post surveys were presented through comparative studies (Table 2 & 3) and presented graphically (Fig. 16 & Fig.17). It has been observed from the comparison that majority of faculty selected a unique video conferencing tool for lecture delivery which helped both them and students to join without technical issue and device compatibilities. Pre-recorded lectures helped students with network interruptions and bandwidth issues to watch the lectures at any time. But initial responses show the faculty had trouble in creating them the pre-recorded lecture. The capacity building program enabled faculty to develop quality pre-recorded lectures and upload them to course websites. The post survey showed that the faculty feels confident to do the same with ease. Almost the entire faculty who attended the program said that technology-enhance learning training program enabled them to build new skills and knowledge on how they can effectively align the technology with the content, pedagogy and assessment.

Table 2. Pre-Vs Post responses of the faculty

Criteria-Faculty Instrument	Pre-Survey	Post-Survey
CANVAS Video conferencing tool used to	24.2%	96.1%

teach courses		
Comfortable to manage course content and teach through the CANVAS LMS?	82.35%	90.3 %
Use the pre-recorded lectures?	63%	98%
Could you able to upload Pre-recorded lectures in course websites?	0-5%	82.7 %
How are you engaging the student during the online classes? If Yes, what are the modes of interaction other than chat box	42.5 %	98%
Are you creating any collaborative activities for your online classes?	48.4%	73%
Interaction with students outside your online classes using course websites (LMS)?	27.25%	69.2%
No challenges while design and implement assessment for your online course?	21%	55.7%
Evaluation of efficiency in online teaching as compare to regular classes?	18%	78.8%
Do you think training provided on Technology Enhanced Learning has helped you to build necessary skills to facilitate online classes?	-------	94.2%
Do you feel more confident in teaching your courses in the online mode after Training on Technology Enhanced Learning?	-------	96.3%
Did the faculty development program on Technology Enhanced Learning better prepare you to teach online as compared to last semester?	------ --	96.1%
Do you think the technology, content, assessment, and pedagogy are aligned for your course?	-------	92.3%

As observed in student responses, the majority of them agreed that they took online lectures through a single video conferencing tool and the orientation program helped them to achieving it as observed in Table 3. The students said they have interacted with faculty through various means like Chat box, Poll questions, Screen sharing, breakout rooms for collaborative learning, enabling microphone, etc. It is observed in Table 3 that 70% of the students said they were willing to take courses online or blended post-Covid which highlighted the improvement in online teaching and learning process at the institution level.

Table3. Pre Vs Post responses of the Students

Criteria-Student Instrument	Pre-Survey	Post-Survey
Learning Management System / Software used for managing the course	74.4%	94%
Video conferencing using CANVAS for online classes	22.8%	82.83%
Comfortable with the LMS being used	75.9%	84.1%
How would you rate the quality of the pre-recorded lectures?	74.4%	85.4%
Provisions for uploading the content in course websites	30.6%	74.2%
How does your faculty interact with you IN the online class?	Chatbox, Microphone	Chatbox (Public &

		Private) Microphone, Screen sharing, Poll questions,
How does your faculty interact with you OUTSIDE the online class?	WhatsApp, Emails	Course Websites (CANVAS-Discussions), Whatsapp, Emails
Is the assessment pattern used in online classes different from the one used in conventional classes?	60%	71.2%
Does assessments were provided to you during online classes?	87%	94%
How would like to have courses post COVID – 19 Pandemic? (Face-Face, Online, Blended)	-----	29.1%, 46.3%, 24.4%
Did the 3-week orientation program conducted prior to start of classes help you get prepared for online learning?	-----	86.2%

5. Conclusion

Education institutes around the globe have been highly affected after the lockdown has been imposed due to COVID19. Both faculty and the students had to shift to remote teaching and learning in online mode within a limited span. To support faculty and students in their transition to online learning, capacity building efforts were taken up on technology-enhanced learning. The detailed capacity building programs were presented and the impact of the training programs was evaluated through the faculty and students post-survey instruments. The comparative analysis provided a clear picture of the positive impact of the awareness created on the effective use of technology by aligning with content, assessments, and pedagogy of the respective courses.

Acknowledgement

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