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An Experimental Journey with Self-Made Online Courses: How does it differ?

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***Abstract*— An effective learner centric environment that creates opportunities for interdisciplinary learning and skill development on recent technologies with self-learning capability has been the prime focus of present education. With the limited infrastructure and teaching faculty, it is not always possible to give multiple learning opportunities to students. Massive Open Online Courses (MOOC) have been a boon to the students for developing their knowledge and skills. There are number of national and international MOOC platforms providing various courses offered by different institutions under a learning framework that may differ with different platforms. Though the students gain knowledge through these platforms, they lack the important elements of learning: Personal interaction and motivation by the instructors. This leads to more drop-outs from the courses offered in these platforms. With the intention of providing the personal interaction and motivation, the institution has developed online courses in the trending domain areas under the new initiatives of the academic process of our institution. Eleven online courses have been developed to promote interdisciplinary knowledge relevant to the engineering curriculum and are currently offered to the students of our institution. This paper presents the experience in the design of these online courses and analyses the performance of the learners in enhancing the skill development in the state-of-the-art technologies. There is a need of understanding whether these self-made online courses make a difference when compared to other MOOC platforms. The student feedback, both quantitative and qualitative, and the performance scores have been analyzed for the same. The observed results are encouraging to proceed with this new initiative.**

***Keywords*— MOOC platforms; Self-made Online courses; Self-learning; Student experience; Performance assessment**

***JEET Category*—Practice**

I. INTRODUCTION

Enhancement of curriculum based on the current needs is always the need of the hour. The flexibility of the curriculum according to the learner needs is a common feature found in education policies across countries. Value-added courses and skill-based courses shall enhance the core-engineering knowledge and shall increase the interdisciplinary learning opportunities for the students across different engineering disciplines. A flexible curriculum requires the learning system to be flexible to enable the students to learn at their comfort. Fixed hours and fixed classrooms may not be helping in implementing such courses. Also, a conventional classroom may not be able to cater to a larger number of learners who have a thirst for interdisciplinary learning. Providing those courses online shall enable the learners to learn at their own pace. Massive Open Online Course (MOOC) platforms serve well for this purpose. There exists lot of courses across different online platforms including Coursera, edX, NPTEL Swayam (India). These platforms provide number of courses in different domains offered by many Universities and Institutions. MOOCs have created the opportunity of getting knowledge from reputed institutions for otherwise it would not happen. Even during the most disrupted times in education for the past two years of pandemic, MOOCs have played a vital role in learning enhancement with high enrolment rates. Despite high enrollment rates, MOOCs face the problem of dropout rates as high as 90% (Ericcson et al., 2017). What shall be the reason for this?

When analyzing the academic factors leading to a greater number of drop-outs from MOOCs, the feedback, interaction and motivation by the instructor (Aldowah et al., 2020, Maheswari, 2021) stand important to the continuation of the course. Personal interaction with a familiar instructor motivates the students and gain the ultimate benefit of pursuing MOOCs. With this thought in mind, every institution can develop self-made online courses tailored to the needs of their curriculum and students. But is it that easy? There are various factors that lead to successful MOOCs development including domain expertise, content development expertise, design expertise, assessment model and appropriate pedagogical interventions to motivate students towards the successful completion. Such a journey has been started in our institution **(Thiagarajar College of Engineering-TCE)** which includes various phases of faculty training, infrastructure development, student awareness and sustaining student motivation. The need for online courses has been realized in the institution even before the emphasis on online courses in India's New Education Policy (NEP) 2020. The academic process team of the institution has initiated the process of developing online courses. This article presents the journey with answers for the most relevant questions with appropriate evidences from the student performance data and feedback responses.

II. LITERATURE REVIEW

Online learning is defined as "learning experiences in synchronous or asynchronous environments using different devices with internet access". In these environments, students can be anywhere to learn and interact with instructors and other students" (Singh & Thurman, 2019). Flexibility, easy access, and interaction between learners and their professors are the major benefits of online learning (Strayer University, 2020). Online learning assists in making the teaching–learning process more student-centered and more innovative. Online learning can promote critical thinking, creativity, collaboration and communication among millennial learners because online platforms enable the instructors to design flexible pedagogies catering to the personalized needs of the learners. It could be inferred from the literature that 80% of course content offered in institutions of higher learning are being delivered online (Allen & Seaman, 2003). However, many of the learners prefer traditional classrooms rather than online platforms. There were few feedbacks like, "Not only does the courses cost more, but they made me feel lost all the time". And "The online class was very boring, and I don't feel the instructor helped me a lot. Researches were carried out to identify the factors for unpleasant learning experiences. Significant amount of research works have been carried out to identify the factors that can enhance the effectiveness of online learning. The findings from a survey emphasize the importance of instructors' perceptions when assessing student dropout or success in MOOCs (Aldowah et al., 2020). It has been suggested (Sun et al., 2016) that that effective online instruction is dependent upon the following three factors namely,

- well-designed course content, motivated interaction between the instructor and learners (Maheswari, 2021), well-prepared and fully-supported instructors;
- creation of a sense of online learning community (Liu, Yi & Wang, 2022);
- rapid advancement of technology.

The satisfaction rate by both participants depends on E-service quality and the information provided (Shahzad et al., 2020). As all the faculty members of our institute have developed expertise in offering classes in online mode during the pandemic period of covid-19, the institute has realized that this is the right time to take online learning to the next level. Online learning can bring radical transformations in education which includes teaching, learning, evaluation, assessment, results, certification, degrees, and so on. (Dhawan, 2020). Having understood the advantages of online teaching, structured approaches for online instructional design, and the motivating factors for improving the completion rate, online courses were developed with the following objectives:

- To create a customized learning repository of value added courses for engineering programmes which can be accessed anywhere at any time
- To showcase the technical expertise of the institution's teaching fraternity to the neighboring institutes
- To create opportunities for interdisciplinary learning without disturbing regular academic hours.
- To provide exposure on the state-of-the-art technologies to the students.

Experiences in the journey of creating these self-made online courses and the analysis of the factors that differentiates this initiative from usual MOOC platforms are presented in this article. The contents are organized as follows: The research questions formulated for this experimental study are presented in section –III. The Standard Operating Procedure evolved for the development of institutional online courses is presented in section-IV. The analysis of the experimental data generated in this research study is presented in section –V. Major inferences on the analysis and the possible extensions of TCE online courses are presented in the concluding section.

III. RESEARCH QUESTIONS

The motivation of this experimental study is supported by the following Research Questions (RQ):

RQ1: What are the parameters that make self-made online courses more preferrable than other MOOCs offered in platforms like NPTEL, Coursera and edX?

RQ2: What is the performance and satisfaction level of the learners in undergoing self-made online courses in improving their interdisciplinary knowledge and skills?

IV. DEVELOPMENT OF **TCE** ONLINE COURSES

To start with the new venture in the institution, a plan for the development of online courses has been developed with the given flow of events as in Figure 1. A standard operating procedure has been developed as given in Figure 2 and appropriate online course structure and guidelines have been formulated by the academic process team. The same has been reviewed and approved by the external experts.

Fig. 1. Action plan for online course development

ADDIE model of online course development (Nichols & Greer, 2016) has been followed in the development of self-made online courses. Figure 2 depicts various phases of ADDIE model with various subtasks. The courses are made

available in 4 /8/ 12 weeks contributing to 1, 2 and 3 credits respectively.

A. Call for proposals

Call for proposals are invited from all the departments of the institution to offer courses of interdisciplinary nature or of promoting the student skills for higher studies. Department coordinators for online courses have been nominated in each department to streamline the process. After refinements, the proposals for 37 courses have been accepted by the academic process team of the institution.

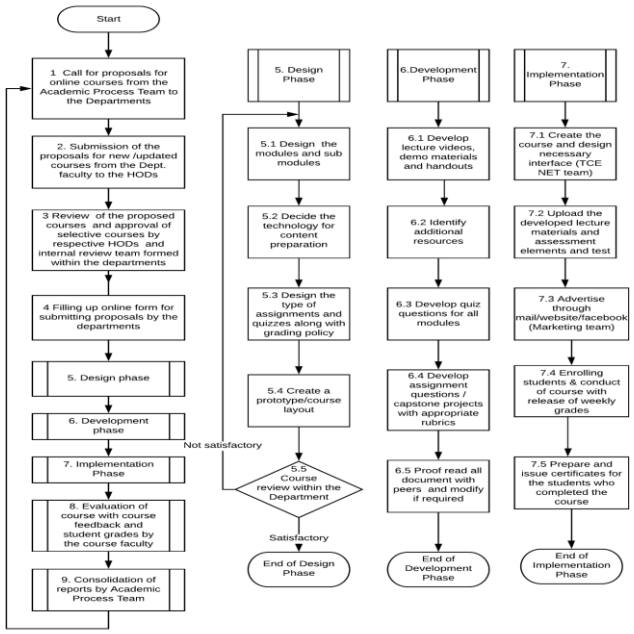

Fig. 2. ADDIE model design of online courses

B. Capacity Building Workshops

Any new initiative needs developing expertise with appropriate training. The process of developing online courses requires a lot of hands-on experience and thus the need for intensive capacity building workshops is realized. There are three different training modes practiced:

- Online workshops and discussion with hands-on training with external experts
- Identification and creation of tutorials by the academic process team for the course faculty to watch, do and learn
- Practice sessions on video recording in digital studio

These workshops, tutorials and practice sessions enable the faculty members to acquire the necessary skills required to develop video content. A WhatsApp group has been created for the members to share their experiences and thus enabling peer learning.

C. Infrastructure Building

Infrastructure building is another major component of developing online courses. A well established and well-maintained technical infrastructure is one of the major keys for its success at schools and universities (Nikdel Teymori and Fardin, 2020). Infrastructure requires the identification of hardware and software resources essential for the purpose. Appropriate hardware and software required for creating video lectures are identified. After identifying the resources, the decisions on usage of existing infrastructure and facilities or purchase of new software and hardware are made and suitable processes have been initiated. As the institution has latest and accessible computer laboratories with necessary hardware, high bandwidth network and digital studio in place, the task of providing necessary infrastructure with existing facilities has turned out to be fruitful. Additionally, video capturing software has been purchased and essential training and tutorial videos have been given to the course faculty to enable them to create highly engaging content.

D. Phased Development

The SOP, training programs and necessary infrastructure development have facilitated the development of various modules in the online Courses. Parallel development of various modules was possible because of the team work involved in content development. To ensure the quality of the content developed, self-review and review by alumni and student volunteers have been initiated. The analysis report of self-review for selected parameters is presented in Figure 3 and the review by students and alumni is presented in Figure 4. It could be inferred that more than 70% of the stakeholders have given the top 2 ratings thereby confirming the quality of the online courses. The subjective feedback was used to refine the videos in modules.

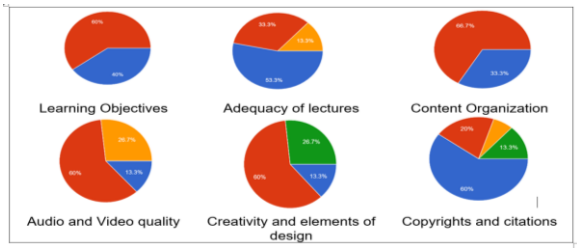

Fig. 3. Self-review during development

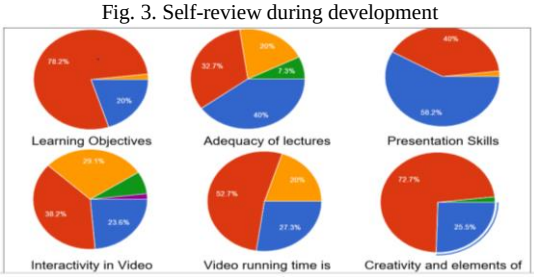

Fig. 4. Student/Alumni review during development

E. Launch of courses

After carrying out the necessary refinements, eleven courses were ready for launch including 8 courses with computer science background and 3 from electronics, communication, and mechatronics background. Moodle has been used for

Learning Management System hosted in the institutional internal server. A separate domain *mooc.tce.edu* has been created to facilitate enrolment of learners and hosting of video lessons, quizzes, and assignments. The user interface for the online courses is presented in Figure 5 and the structure of a course is presented in Figure 6. Enrolments for all the eleven courses were open to undergraduate and postgraduate students of all branches of engineering in the institute. Around 584 learners have made 929 initial registrations in the set of eleven courses and the enrolment statistics is presented in Figure 7. Majority of the learners have shown interest in the state-of-the-art technologies like Data Science, Blockchain and Mobile Application Development. On successful completion of the courses the learners are awarded with one credit under regular academics.

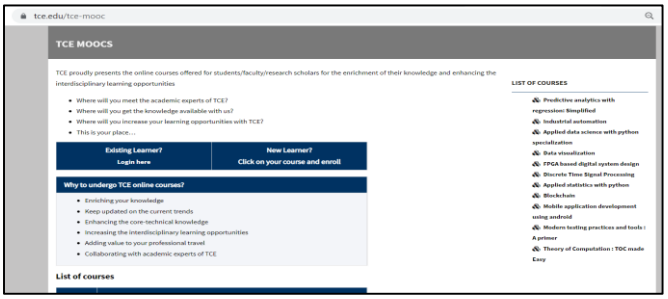

Fig. 5. User Interface of the Online Courses (https://tce.edu/tce-mooc)

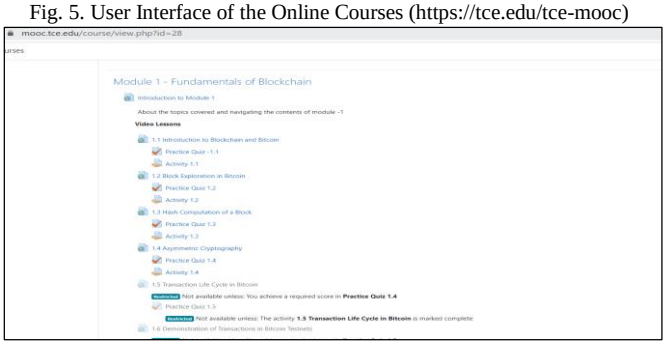

Fig. 6. Sample Course structure

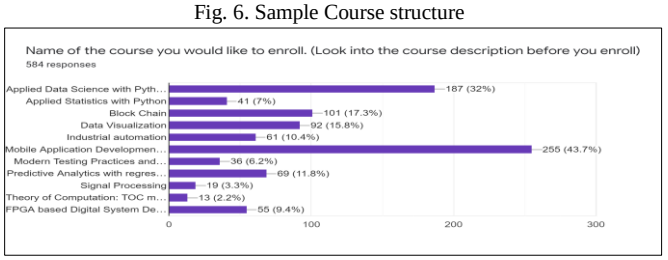

Fig. 7. Student enrolment in the courses

WhatsApp groups have been created by the course coordinators for the students enrolled in their course for doubt clarification and ensuring the timely completion of weekly quizzes and assignments. After completing all the modules, a proctored online terminal examination has been conducted for the eligible students who have passed the internal assessments. A course evaluation survey has been done with the content as specified in Table I and a Focus Group Discussion (FGD) is conducted with representative students from each of the 11 courses with the focus questions as specified here: 1) Appreciating factors 2) Challenging factors 3) Features to be improved 4) Views on interface 5) Best practices. A research work (Liu, Yi &Wang, 2022) presents a guideline that matches with the feedback questionnaire designed for this study.

TABLE I
STUDENT FEEDBACK QUESTIONNAIRE

Criterion	**Criterion Parameters**				
Content (5-point Likert Scale)	Learning Objectives are clear	Organized and well planned module content	Appropriate workload	Easy to understand	Engaging and interesting
Content Delivery (5-point Likert Scale)	Quality audio and video	Interactive lecture content	Effective discussion forums	Appropriate other learning resources	Additional resources
Assessment (5-point Likert Scale)	Significant gain of skill/knowledge	Different cognitive levels in quiz	Tasks given stimulates higher order thinking skills	Time and plan for assessment is good	Well defined rubric
Moodle Interface (5-point Likert Scale)	Easy course navigation	Helpful status icons	Easy location of learning materials		
Rank for the following MOOCS platforms (1-high to 5-low)	Self-made MOOC	NPTEL	Courseera	edx	Other platforms
Open end response questions	Most useful aspect	Aspects to be improved	Reason for choosing the course	List of courses expected	
Recommendation to friends	Yes/No				

F. Methods associated with the research questions

At first, the quality of the survey questionnaire is assessed with Cronbach alpha coefficient. For answering to research question 1, a quantitative analysis of feedback responses of the students through survey questionnaire and a qualitative analysis of the excerpts of a Focus Group Discussion (FGD) are taken. The questionnaire expects students to rank different MOOCs platform in the order of their preference. The ranking is analyzed to understand whether institution's MOOCs is preferrable. The open responses of the feedback are analyzed by forming word clouds with the responses. The excerpts obtained from the FGD are presented.

To answer to the satisfaction of students in research question2, the percentage of positive responses for the Likert scale questions are observed to find the success of this initiative. A Success Index (SI) is calculated as given in Equation 1 (Kavitha & Anitha, 2021). Ideal SI value is 1 which is the possible highest score and the worst score is 0 which makes the range of SI between 0 to 1.

$$SI = \sum_{i=1}^{NQ}\sum_{j=1}^{NS} \frac{Number\ of\ students\ with\ jth\ response\ for\ ith\ question\ X\ W_j}{Total\ students\ X\ Number\ of\ questions\ X\ Maximum\ weightage} \quad (1)$$

Where, NQ= 18 (Number of questions in Likert scale)
NS= 5 (Number of scale)
Wj- Weightage of jth scale (Strongly Agree – 5; Agree -4 ; Neutral -3; Disagree – 2; Strongly Disagree – 1)

For answering to the performance level in research question 2, a quantitative analysis of the performance scores and drop-out rate is performed. All the statistical analysis and word processing are done in ***Python***.

V RESULTS & DISCUSSION

A. Cronbach alpha test

The feedback responses of the student for the questions with Likert Scale has been analyzed for the validity of the questions with Cronbach alpha test. The test gave a value 0.998 and thereby ensuring the quality of the questionnaire.

B. Analysis of Likert Scale responses

Among 584 registered students, 204 students have responded to the survey questionnaire. Success Index score is calculated according to Equation 1. With total number of students as 204 and maximum weightage factor as 5, SI calculated for 5 different responses for 18 Likert Scale questions. The obtained SI value is 0.8678, which indicates 86.78% satisfaction among students. This indicates an excellent satisfaction level among students with the self-made online courses.

C. Analysis of ranking of MOOCs platforms and recommendation

The students have been asked to assign ranks for the different MOOCs platforms including self-made MOOC platform (Rank 1 – high preference to Rank 5 – Low preference). A ranking formula has been devised to find a consolidated score for the ranks. The highest rank (Rank 1) is given a weight factor of 5 while the lowest is 1. The ith platform's preference score is calculated with Equation 2 where j is the rank given by the students for the platform i. The consolidated preference scores are given in Table II.

$$Pref.Score(i) = \frac{\sum_{j=1}^{5} No.of\ responses\ for\ jth\ rank*(5-j+1)}{Total\ students\ x\ Maximum\ weightage} \quad (2)$$

Table II
PREFERENCE SCORES

Platforms	Pref. Score
Self-made MOOC	0.749
NPTEL	0.683
Coursera	0.703
EdX	0.532
Other platforms	0.332

Also, they have been asked whether they would recommend these online courses to their friends. 82% of students would recommend these Online courses to their friends and the percentage of students who would not recommend the same is 0%. The very important reason that this research work has identified for the preference is the frequent teacher interaction which is made as a mandatory element and the flexibility to motivate students to complete the task. The teacher-student interaction is a much-needed element according to a research work (Bouilheres et al. 2020; Attard & Holmes, 2020).

D. Analysis of open-end responses of the questionnaire

The responses for the open-ended questions are framed into a word cloud using Python to understand the intensity of the words that are frequently appreciated. Figure 8 gives the word cloud for the most appreciating factors. From the figure, it shall be observed the most appreciated features of self-made Online courses are Quizzes, Assignments, Video, Concept understanding, Practical demonstrations, and lectures. Many of the students have used the adjectives "interesting", "useful". Recurrent occurring of these features and adjectives give an understanding of the positive impact that these online courses make on students. Figure 9 represents the major concerns of the student in the platform. The video quality, content explanation and code demonstration shall be improved in some of the courses. It is also understood that student love offline mode as well. This is in line with the research findings in online course implementations. Video quality and poor understanding of learning objectives are quoted as major challenges in online learning (Rasheed et al., 2020)

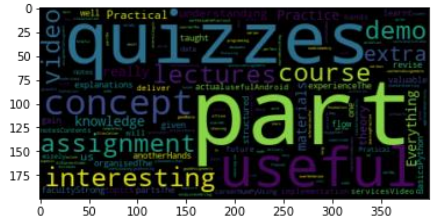

Fig. 8. Word cloud for appreciating factors

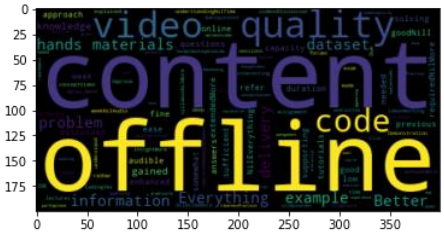

Fig. 9. Word cloud for factors to be improved

E. Analysis of FGD excerpts

The FGD excerpts are analyzed and given in four different dimensions

1) Appreciated Factors:

a. Familiarity with the course instructors
b. Approachable faculty team
c. Flexible timelines
d. Understanding the learners and catering to their needs

2) *Challenges*

a. Use of external tools for completing the assignments
b. Phased release of modules
c. Need of visualization in completion tracking
d. Less reminders about completion time
e. Lack of lecture materials to prepare for assessments
f. Less interaction with course faculty during the course
g. Less usage of discussion forums

3) Features that shall be improved

a. Simultaneous release of all modules
b. Flexibility in assessment deadlines
c. Live interaction with course faculty in between
d. Weekly reminders in email and WhatsApp
e. Animation and graphics in lecture videos
f. Provision of video transcripts
g. Solution videos for quiz questions and programming assignments
h. Improvement of video and audio quality
i. Live demonstrations (Not as slide contents)
j. Skipping of watching in videos
k. Asynchronous practice quizzes and synchronous live quizzes

4) *Best practices*

a. Practice quizzes
b. Step-by-step guidance for installation and execution of software programs

F. Analysis of student performance

Among 929 individual course registrations, the total number of eligible students who qualify for the final proctored online exam is 362 (38.97%), which is a good turn over rate when compared to the general statistics of 10% completion level in MOOCs.

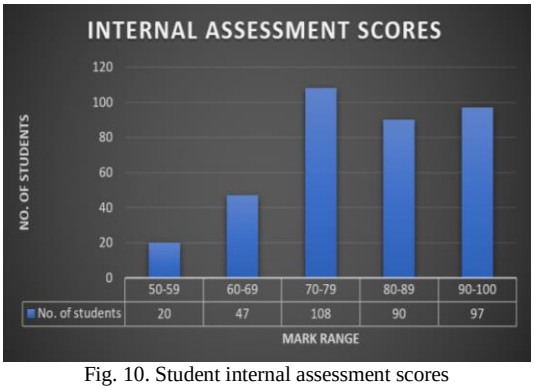

Fig. 10. Student internal assessment scores

Figure 10 presents the internal assessment statistics of the students who attended all the assessments in all the courses. 27% of the students have got above 90% and 81.5% of students have got above 70% .

G. Discussion on Research Question 1

From Table II, it is evident that students who have attended the institution's online courses for the first time had a strong preference to them than any other platforms with a preference score of 0.749. The score is greater than any other platforms. Also 82% of the students are ready to recommend these online courses to their friends.

The parameters that make up this preference can be observed from Figure 8 and the excerpts from FGD (Section V. E). The most appreciated features of the online courses are Quizzes, Assignments, Video, Concept understanding, Practical demonstrations and lectures are the parameters that made these courses to be preferential. Additionally, the other supporting parameters are: 1) Familiarity with the instructor and approachable faculty team 2) Flexible timelines 3) Need based delivery 4) Practice quizzes 5) Step by step guidance for execution of software code that enabled students who are new to software to learn quickly. The findings stay in line with the finding of the research work (Van wart et al., 2020) that Instructional Support, teaching Presence and online interaction are among the most essential elements of online learning.

H. Discussion on Research Question 2

86.78% of Satisfaction Index obtained from the feedback responses clearly states the satisfaction level of students in the self-made online courses has been quite high. From Figure 10 on student performance record, 81.5% of students have got above 70% in the internal assessments and thus creating high performance record. Hence, we shall declare that performance level and satisfaction level of the students are high in these Online courses.

I. Discussion on further improvements

Institution's online courses shall be further improved by considering the students' open-end responses and FGD excerpts. Following are the suggestions to the team for future improvements.

1) Maintaining uniform quality of audio and video
2) Effective software demonstrations and hands on
3) Practice quizzes for every video
4) Periodical reminders to students on deadlines
5) Synchronous meeting sessions with faculty
6) Interactive platforms to make interactive videos
7) Solution manual for quiz and assignment problems
8) Provision of video transcripts and text materials

VI CONCLUSION

Institution's online courses have significantly opened the possibilities for interdisciplinary and self-learning. The process of development of the Online courses, outcomes and challenges have been presented in the article. Analysis of completion statistics, performances of the learners in

proctored examinations are found to be satisfactory. Learners prefer a customized online learning system which was created by the known instructors. Learners also prefer to watch short videos with appropriate practice quizzes. Scheduled office hours either in online or offline mode help the learners to manage deadlines and to clarify their doubts and misconceptions. The possibility of offering these courses to the neighboring institutes and development of other demanding courses as Phase II shall be the future extensions for the project. The ways to use the discussion forums of learning management system effectively shall also be explored. Support for content digitization and video editing are also being explored to reduce the workload of instructors for preparation of online courses.

The first trial of this experiment is positive in terms of student experience and performance. The next research in this direction shall be course specific comparisons and improvement in content, delivery, and assessments. Also, the possibility of introducing gamification and collaborative elements shall be analyzed for creating a dynamic learning environment.

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