Paradigm Shift in Engineering Education During COVID 19: From Chalkboards to Talk Boards

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***Abstract* - Traditional teaching got a blow during lockdown because of pandemic condition and all of a sudden a need for transformation from traditional teaching to technology oriented teaching was realized. The paper aims at elaborating the paradigm shift in engineering education teaching and learning methods using online tools and focuses on evaluating the usability of proposed online learning models by the students. Data is collected through a survey questionnaire responded by 60 students of the engineering of Chitkara University. The findings are limited to only one mode of platform that is gotowebinar so they cannot be generalized beyond this concept. Future research should be considered using all possible platforms, which are available for higher education teaching. Originality– This research explores the determinants of education's acceptance of online mode of education and also the adoption from chalkboards to talk boards.**

Keywords— Webinars, Covid19, higher education, assistive-tool, educators.

I. Introduction

Traditionally engineering education centered on content based education and infused problem-solving skills in learners. Collaborative problem-solving and critical thinking skills have also recently been introduced. In the last 50 years, the amount of content for engineering students has steadily increased [1]. The curriculum has continued to change but often without much debate by the engineering curriculum design committees. In recent years, online access to engineering study from anywhere and at any time has become achievable but is not yet comprehensive in all engineering education areas. Many special needs of undergraduate engineering education have not been adequately served by online training methods. Laboratories in particular form the backbone of engineering education, in addition to design tools and mathematical foundations. Because of the traditional desire for the direct use of instruments, laboratories are very difficult to offer through online mode specifically hardware-oriented laboratories. Similarly, learning materials that require greater use of mathematics have not been easy to implement through online teaching. Further, time taken in developing content for e learning and use of online platforms to deliver these contents are still challenging tasks for few of the engineering courses [2-4]. The world is at war with COVID-19 and economies around the world have announced a lockdown to avoid the further spread of the disease [5]. Following the instructions given by the government, even schools, colleges and universities have been closed on a very short notice [6-7]. So, they had to find new ways to deliver the lessons, and online classes were the way forward. The epidemic has forced the world to be isolated and several webinar platforms take this opportunity to replace the professional, academic, and social activities from offline to online [8]. This change happened so suddenly and it has been observed that many of us are not prepared enough to face the challenges of this paradigm shift in teaching. These challenges are not only for educators, various students have also faced problems in this abrupt transition from offline to online learning.

With rising population and rising costs, brick-and-mortar classes are less likely to meet the demands for higher education [9-10]. Online education will become the future education prospects and this Covid-19 gave this opportunity to various educators and learners to explore the effectiveness of online teaching. Engineering courses have special requirements when offered in distance mode, including consideration of how best to provide lab experience. For online engineering education to be widely accepted and used (i) Online course quality should be comparable or better than traditional class(ii) Courses should be available to any number of students from anywhere when necessary (iii) topics across the wide curriculum of the engineering courses should be available [1]. These online classes will eventually give students low cost, more choices and diversification.

Online education has continually changed the idea of open learning since the early 90s [9]. Previously Massive Open Online Courses (MOOCs) have produced a paradigm shift in online education by providing free quality education to anyone, anywhere with Internet access. The onset of MOOCs may seem sudden, but it is the next stage in the development of Open Educational Resources (OER). From

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Open Learning Objects (LOs), OER became the Open Course Ware (OCW) and has now grown into MOOCs and many universities are now participating in these open learning courses [11]. The democratic element of teaching through MOOC is very appealing to teachers because they can teach students all over the world in one class which they cannot do otherwise. Coursera and edX are the two main companies that provide MOOC. Coursera (www.coursera.org) is seeking 679 courses in 25 subjects, while edX (www.edx.org) is proud of 212 courses [9]. Companies offering MOOC platforms are also expanding and many renowned universities are teaching courses through these platforms. This difference can be easily measured by the increase in online students, from almost none in the last 10 years to over 2 million online learners [1]. Webinars are not a new technology but it was originally developed as a marketing tool for companies to promote their services and products. Other uses of webinars include training, group meetings and more recently, during the COVID-19 disaster, the presentations and lectures in education [12-13]. Webinar can be defined as a lecture or other presentation that takes place on the Internet, allowing participants to see and hear the presenter in different locations, ask questions and sometimes respond to polls and survey [14]. If a webinar design consists of the six aspects namely: (i) pedagogical and instructional strategies; (ii) content; (iii) presentation style; (iv) platform; (v) netiquette; and (vi) evaluation, then it can result in an enhanced student learning experience [12].

This paper presents a case study on usability of webinars as a learning tool for first year engineering students of Chitkara University, Rajpura Punjab, India. Students actively participated in this study and made it more meaningful. They gave their feedback and concerns through the google feedback form. The other sections of the paper explain the background of webinar technology, proposed work, conclusion, and future scope and references.

II. OVERVIEW OF WEBINAR TECHNOLOGY

There have been extensive studies, which attempt to investigate the impact of teaching-learning strategies (such as issue based learning, multimedia mediated learning, the flipped learning, etc) on the student's motivation, student's perception, satisfaction, etc. For example, Wei li investigated the student's understanding and motivation level for one of the course teaching through two different approaches such as conventional teaching method and multimedia mediated learning [15]. The study examined that the interactivity feature of multimedia-mediated learning provides a better understanding of the topic as compared to the conventional approach. Burke et al. investigated the student engagement during the class time through different teaching methodologies i.e. traditional, flipped, and online teaching approaches [16]. The study indicated that the flipped teaching approach had put a positive impact on student engagement, as it includes an active learning environment as compared to other two approaches. Moghavvemi et al. Investigated that social media platforms act as a complementary tool in teaching-learning activities [17]. It has been observed that YouTube is the most widely chosen platform by the university students. Johnson et al. presented that teaching nursing procedures through YouTube helped a lot to enhance student's attention and retention [18]. Students learn more when they visualize things rather than auditory ones. Also, Balakrishnan reported that different teaching-learning styles had shown a difference of opinion in the usage of social media technology for learning [19]. Meguid et al. presented a comparative analysis of interactive and traditional teaching. The study reported that incorporating poll questions while lecturing helped to maintain the attention level of the students, and develop active learning amongst the students [20]. Besides, student's responses through these polls could help the teacher to change their teaching style. Clarks revealed that different teaching-learning approaches with technology-enabled learning could enhance active learning amongst the students who belong to Generation Z [21]. As generation Z believes in learning through technology rather than taking notes. Szeto et al. investigated the student's social presence experience in terms of online teaching and face-to-face teaching [22]. The findings reported that both the environments have their own pros and cons. The papers suggested adopting a blended learning environment for the better interaction amongst the students.

III. PROPOSED ONLINE LEARNING MODEL

E learning was always a popular channel of learning and delivering educational content amongst those who were not able to physically join sessions or amongst those who wanted to update and upgrade themselves. But the group adapting it was really very small. A forced opportunity was provided by pandemic during lockdown, to deploy a course in blended mode (i.e. Half offline and half online). Authors of this paper employ this approach in teaching Digital Electronics and Logic Design courses to first year engineering students. In this case half of the course was already covered through physical teaching and the rest half of the course was yet to be covered through online mode. This was a big challenge and included certain issues and requirements before the actual launch of lecture on online mode. These requirements are presented by figure 1 below:

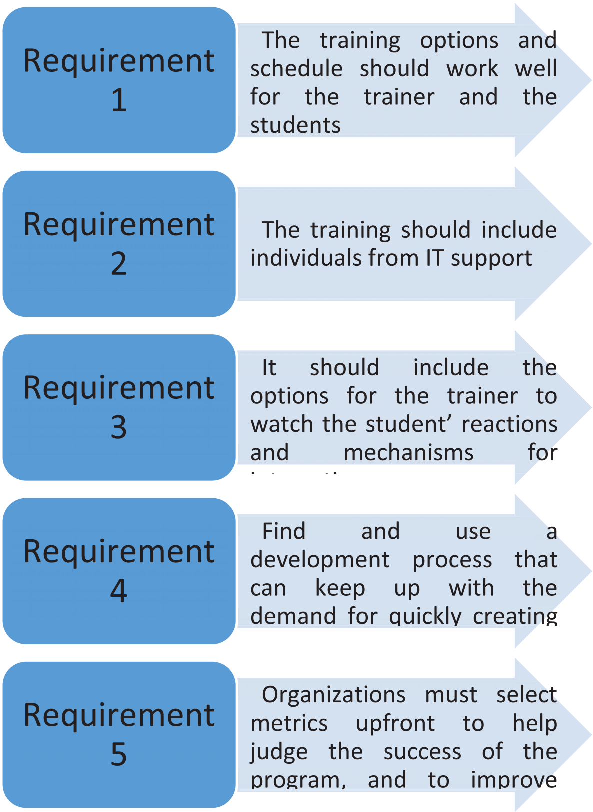

Fig 1: Basic requirement for online learning

a) Course Design in online learning model

The proposed online learning model is as shown in figure 2, which depicts the use of two digital platforms to conduct the course of Digital Electronics and Logic design.

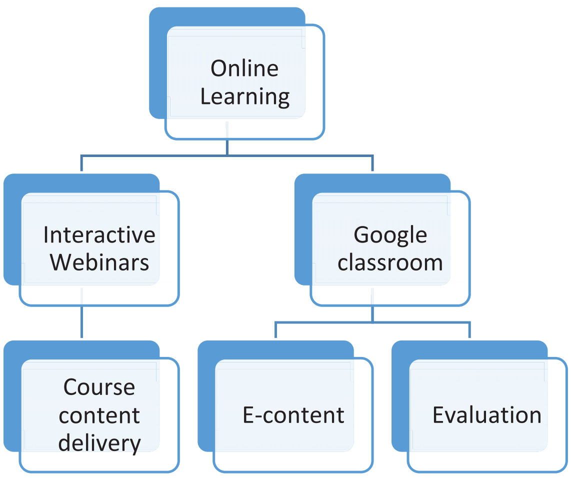

Fig 2: Proposed Online learning Model

According to this model Go-to-webinar was chosen after testing several others as a webinar delivery platform and Google classroom used to share the relevant course material and take formative assessments for the course. In order to make webinars more meaningful, its functionalities need to be explored. Figure 3 shows the teaching pedagogy followed while delivering interactive webinars. In this case features like polls, surveys and Q&A features of the webinar platform used extensively to make interaction livelier with students.

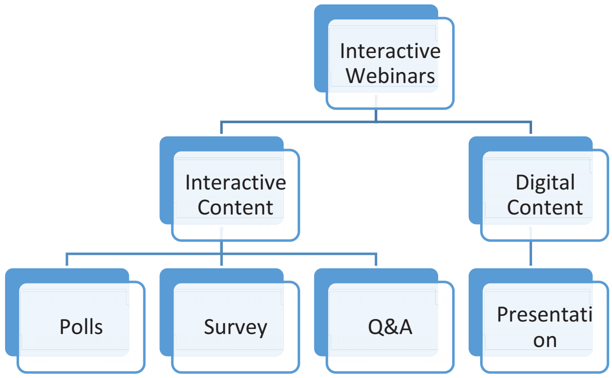

Fig 3: Block Diagram for interactive webinars

As per figure 3, interactive webinars use well defined polls, surveys and live Q&A sessions. This approach becomes more productive and increases attentiveness of the participants. This measure of attentiveness is also provided by the Go-to-webinar platform. Every online lecture planned as follows:

i. Introduction of the objective and outcomes of the lecture in the beginning.

ii. The lecture was subdivided into smaller ones and a poll launched after completion of every section.

iii. Live Q&A session goes throughout the lecture, in which faculty unmute any of the students and can ask questions related to the section going on. also if student get any doubt he/she can raise their hand so that the teacher can unmute them and they can ask their doubt. In this way the webinar session becomes more interactive and students can learn efficiently.

iv. Ten minutes reserved for a discussion session in the end.

v. Survey shared at the end of the lecture once students exit from the webinar platform to record their feedback response. Figure 4 and Figure 5 shows sample images of the live interactive webinars going on and google classroom of the student's shows course contents respectively.

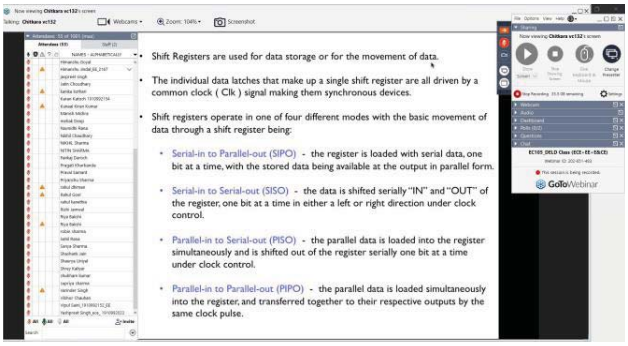

Fig 4: Sample of the live Webinar

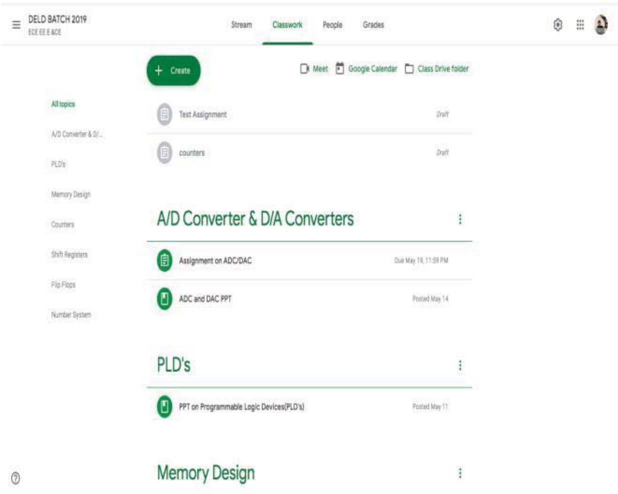

Fig 5: Sample of the google classroom

b) Learning Model Effectiveness

On completion of course it was really important to analyze the effectiveness of the course-learning model. It was studied using parameters participation of students and course evaluation as shown in table 1.

Table 1. Metrics used for course evaluation

Area of Evaluation	Metrics
Participation	Number of students enrollment Number of students attended
Learning Model Evaluation	Based on survey questions on course content, instructor, and pace.

(i)Participants

The first stats that gives a clear picture towards the success of the course is the number of students that actually attend the course after getting enrolled. From the attendance report generated by the Go-to-webinar platform it is evaluated that a total of 61 students enrolled for this course and out of them 55-58 were always present in the online class. Which means a total of 90% of strength. Which indicates that the students accepted the online mode and they show willingness to learn. The demographic representation on the basis of the gender of the participants is shown below in fig 6.

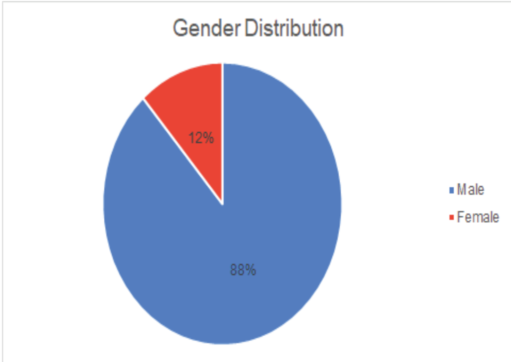

Fig 6: Gender distribution of the participants.

It shows that 88% students are male and 12% are female. The overall average age of the students is 18.63 years.

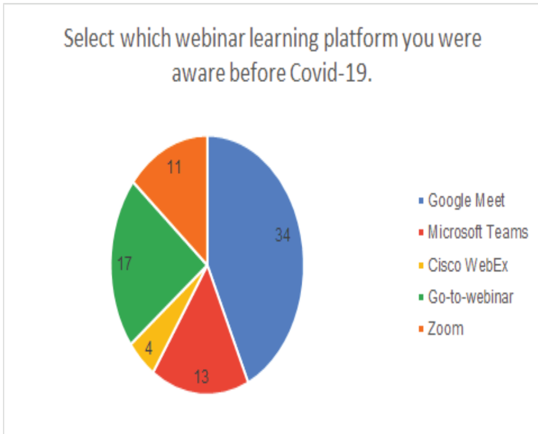

Fig 7: Prior knowledge of webinar platforms.

Figure 7 shows the prior knowledge of webinar platforms or video conferencing tools by the students. The data revealed that a maximum number of students were aware of the Google meet platform for meetings and video-conferencing requirements. After that Microsoft teams and Zoom platforms were other commonly used platforms. Figure 8 predicts about the agency from where they get information about use of online-learning platforms. The data shows that their organization gives them awareness of the online-learning platforms.

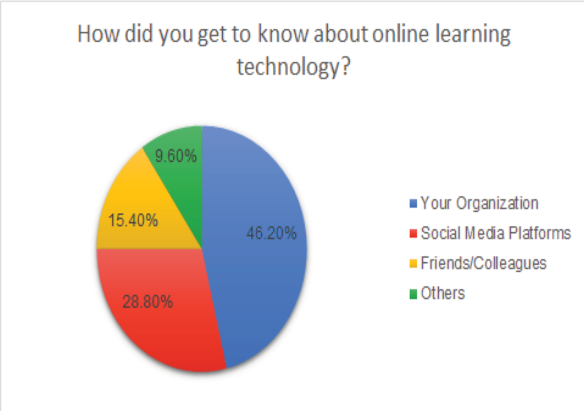

Fig 8: Knowledge about the specific online webinar technology

(ii) Learning Model Evaluation

After the completion of the course students provided a survey questionnaire through the google form and the link for the same is as https://docs.google.com/forms/d/e/1FAIpQLScgq7nNs99nERn5JzlSoL2OI8WAEnuOXM1SUFp_HrSGF_k0ug/viewform?usp=pp_url

The survey questionnaire contains ten items designed on a five-point Likert scale to assess the usability of system. The questionnaire focuses on ease of use and usefulness of the system

S.No	Item	Average Score
1	I understand that I'd like to use this webinar program frequently	3.62 (2.62)
2	I really have found the webinar system dynamic	2.58 (2.42)
3	I figured it was a webinar that was easy to use.	3.52 (2.52)
4	I think I need the help of a professional individual to use the webinar.	2.38 (2.62)
5	In this webinar framework, I found that different features were well integrated.	3.67 (2.67)
6	I consider it a little bit incompatible with the software.	2.54 (2.46)
7	I'd imagine the majority of people would learn to use this webinar system very fast.	3.69 (2.69)
8	I found it very complicated to use the webinar system.	2.08 (2.92)
9	In using the webinar system, I was confident.	3.87 (2.87)
10	I 'd learn many things before I started to use this webinar system.	2.63 (2.37)
Total SUS Score		26.16
SUS Score in %age (2729 * 2.5)		**65.4%**

In the next step, participants share their experience with the use of webinar tools for learning an engineering subject. They were also asked about the difficulties they face when transitioning from chalkboards to chat boards. The experience has measured via John Brooke 's 1996 device usability survey (SUS)[19] questionnaire. This questionnaire covers the topic of course results covered by webinars, easiness to use a platform chosen for teaching and eventually its guidance to others to select courses and online learning platforms. Participants must demonstrate their confidence in the use of webinars in terms of education defined on a scale of 1 to 5, where 1 is "strongly disagreeable." 5 is "strongly agreed."

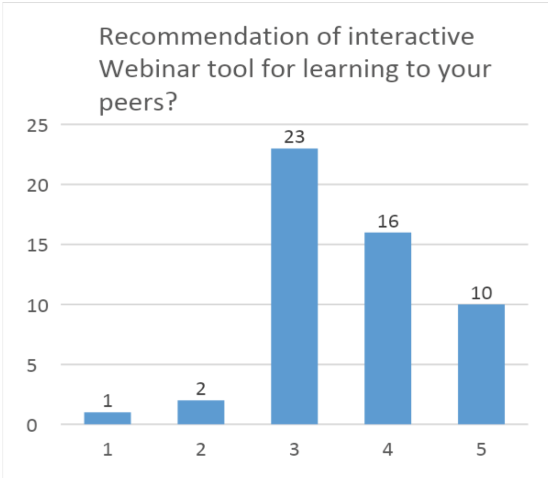

Fig 9: Recommendation for the use of platform

The participants were satisfied with the tool and more than 50% of them showed the interest in recommending it to peers while the other 40%-45% were neutral.

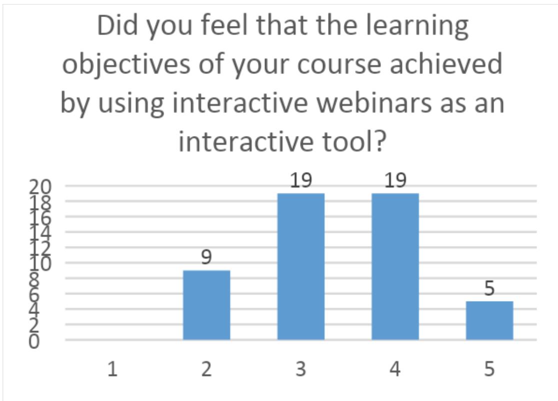

Fig 10: Measure of learning outcome

80% of the students agreed that the learning objectives were achieved through the interactive webinar. Thus making it a better system of teaching and learning during adversities.

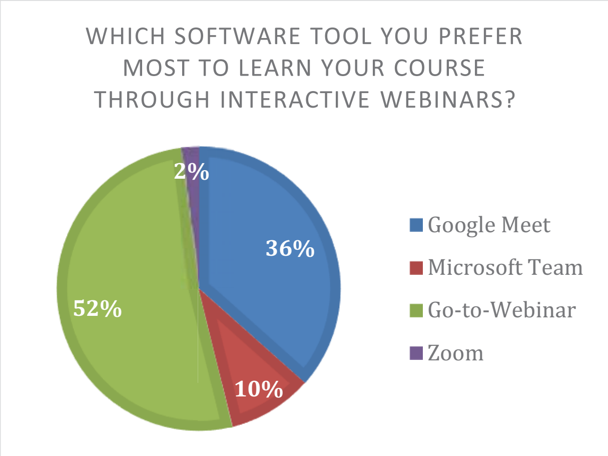

Fig 11: Preference for the online platform

On the recommendation of the tools 52% of the participants preferred to recommend this tool to their peers while the other 48% got divided for other platforms making the majority satisfied with this tool.

According to John Brooke method to calculate system usability, the overall score higher than 58% is acceptable for any system to be used on a large scale by the consumers. For this case study, the overall score obtained is 65.4%, which means that the interactive webinar system is accepted and liked by the students of the university significantly [14][15].

IV. CONCLUSION AND FUTURE SCOPE

The webinar is an online mode of content delivery that was not used before the pandemic outbreak of Covid-19 by the universities for teaching. The abrupt change in the teaching-learning cycle examined the true potential of information technology systems in every country of the world. Webinars or online learning platforms have emerged as true saviors in order to reduce the negative effect or loss of educational time. Moving from offline to online teaching requires well-planned execution by the administrative authorities. The exploration of different platforms, the training of faculty members and students, the holding of demo sessions and the introduction of online assessment platforms are proving useful in this hourly need. A case study was carried out on the students of Chitkara University, Rajpura, Punjab, India in order to evaluate the usability and acceptance of interactive webinars while undergoing the transition from offline to online mode of teaching and learning. The study showed that the rate of acceptance of this technology by the students of the university was 65.4%. Also 80% of the students agreed that the learning outcomes of their respective course were successfully achieved through online teaching. In the end, because this webinar technology is the result of information technology, the backbone of which is Internet connectivity. For this cause alone, faculty members have had trouble performing their sessions a number of times. Many challenges include pen writing, contact with the audience, and communication with the audience, and assessment. Potential research in this regard is to train faculty members to make their session more enjoyable and to increase the rate of achievement of the learning outcome of the course. Efforts are also being made to make the assessment more and more authentic, so that students can prepare well and learn more sincerely.

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REFERENCES

[1] Bourne, J., Harris, D., & Mayadas, F. "Online Engineering Education: Learning Anywhere, Anytime".Journal of Engineering Education, 2005.

[2] T. Adeyinka and S. Mutula, "A proposed model for evaluating the success of WebCT course content management system," *Comput. Human Behav.*, 2010.

[3] X. Chen, G. Song, and Y. Zhang, "Virtual and remote laboratory development: A review," in *Proceedings of the 12th International Conference on Engineering, Science, Construction, and Operations in Challenging Environments - Earth and Space 2010*, 2010.

[4] J. Dutton, M. Dutton, and J. Perry, "Do Online Students Perform as Well as Lecture Students?," *J. Eng. Educ.*, 2001.

[5] Amit Kumar Arora 1*, R. Srinivasan "Impact of Pandemic COVID-19 on the Teaching – Learning **Process:** A Study of Higher Education Teachers" Prabnadhan: Indian journal of management 2020.

[6] https://voxeu.org/article/impact-covid-19-education

[7] M. Hacker, S. Cavanaugh, C. De Haan, A. J. Longware, M. McGuire, and M. Plummer, "Engineering for All: Classroom Implementation," *Technol. Eng. Teach.*, 2018.

[8] Jorge Reyna "Tips to avoid Zoomitis in the age of COVID-19" AITD Journal 2020.

[9] Iqbal, S., Zang, X., Zhu, Y., Chen, Y. Y., & Zhao, J. "On the impact of MOOCs on engineering education" IEEE International Conference on MOOC, Innovation and Technology in Education (MITE) 2014.

[10] R. Hariharan, "Online Faculty Development Program -A Case Study," in *Proceedings - 2017 7th World Engineering Education Forum, WEEF 2017- In Conjunction with: 7th Regional Conference on Engineering Education and Research in Higher Education 2017, RCEE and RHEd 2017, 1st International STEAM Education Conference, STEAMEC 2017 and 4th Innovative Practices in Higher Education Expo 2017, I-PHEX 2017*, 2018.

[11] C. Y. Lester, "Mitigating the STEM crisis through enhanced online learning," in *eLmL - International Conference on Mobile, Hybrid, and On-line Learning*, 2014.

[12] Dr Jorge Reyna, Dr Brett Todd , Dr Jose Hanham "A Practical Framework to Design Educational Webinars in the Age of COVID-19". EdMedia + Innovate Proceedings 2020

[13] T. National Academy for Integration of Research and Learning, "Flexible Learning: Proceedings of the National Academy for Integration of Research, Teaching and Learning Annual Conference (4th, Dublin, Ireland, October 6-7, 2010)," *Natl. Acad. Integr. Res. Teach. Learn.*, 2011.

[14] Hudepohl, J., Dubey, A., Moisy, S., Thompson, J., & Niederer, H.-M. "Deploying an online software engineering education program in a globally distributed organization".

Conference on Software Engineering - ICSE Companion 2014.

[15] Y. W. Li, “Transforming Conventional Teaching Classroom to Learner-Centred Teaching Classroom Using Multimedia-Mediated Learning Module,” *Int. J. Inf. Educ. Technol.*, vol. 6, no. 2, pp. 105–112, 2016.

[16] A. S. Burke and B. Fedorek, “Does ‘flipping’ promote engagement?: A comparison of a traditional, online, and flipped class,” *Act. Learn. High. Educ.*, vol. 18, no. 1, pp. 11–24, 2017.

[17] S. Moghavvemi, A. Sulaiman, N. I. Jaafar, and N. Kasem, “Social media as a complementary learning tool for teaching and learning: The case of youtube,” *Int. J. Manag. Educ.*, vol. 16, no. 1, pp. 37–42, 2018.

[18] C. I. Johnson and R. E. Mayer, “A Testing Effect With Multimedia Learning,” *J. Educ. Psychol.*, vol. 101, no. 3, pp. 621–629, 2009.

[19] V. Balakrishnan and C. L. Gan, “Students’ learning styles and their effects on the use of social media technology for learning,” *Telemat. Informatics*, vol. 33, no. 3, pp. 808–821, 2016.

[20] E. Abdel Meguid and M. Collins, “Students’ perceptions of lecturing approaches: traditional versus interactive teaching,” *Adv. Med. Educ. Pract.*, vol. Volume 8, pp. 229–241, 2017.

[21] B. B. Clark, “The Challenge of Teaching,” *Educ. Forum*, vol. 35, no. 3, pp. 314–321, 1971.

[22] E. Szeto and A. Y. N. Cheng, “Towards a framework of interactions in a blended synchronous learning environment: what effects are there on students’ social presence experience?,” *Interact. Learn. Environ.*, vol. 24, no. 3, pp. 487–503, 2016.