Research Article

Academia adapting to e-Learning: A survey on Indian engineering educational

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Abstract

The Covid-19 pandemic caught the world off guard with its precipitance and virulence alike. Forced indoors, the human race is learning to stay indoors and work from home. Among the sectors hit hard, education is probably the worst hit as it affects the future. Trying to adapt to the online mode of learning, teachers and students are grappling alike with technology, attention spans, traditions and the like. This paper, based on a survey conducted among engineering students in India, tries to figure out the major problems faced by students in adapting to e-Learning. The responses have been classified based on the area covered in the question and analyzed. The findings, some trivial, some sensitive while some being eye-opening, would certainly contribute to policy framing initiatives of the government and private agencies investing in e-Learning.

Keywords: e-Learning, survey, online learning, blended learning, efficacy, pedagogy, teacher-student interaction

Introduction

Post Covid-19, the world has changed all too drastically. People are now confined indoors to prevent being infected and stop the spread of the deadly virus. Working from home has become the new normal in almost all spheres of human activity. Education is probably the field of work that has been most affected by this paradigm shift as century-old traditions and methods need to be reworked and adjusted. Over the last year and a half, with schools, colleges and universities closed, online education has been the sole mode of learning. While online learning or e-learning as it is popularly known, has been around for some time now, such widespread and large-scale application and use were never expected.

The term e-Learning was coined and first used in 1999 by Elliot Masie (Guttirez n.d), the first attempts at e-Learning date back to 1924 when Sidney Pressey created the Automatic Teacher, the very first electronic learning machine (Sander, 2019). In 1960, Donal L. Bitzer built PLATO, a computer system for online learning (Sander, 2019). The advent of the internet brought about a sea change in the way people communicated and e-Learning was also influenced. While initially it was restricted to only sharing of text and documents to be used as learning material, advances in web technologies soon facilitated online lecture delivery, modular course content and proctored evaluation.

In the Indian context, Distance Education

providers like Indira Gandhi National Open University (IGNOU), B. R. Ambedkar University, Annamalai University and Sikkim Manipal University started in the early 2000s utilizing Information and Communications Technology (ICT) for their courses (Kawatra & Singh, 2006). While such courses are popular, there exist restrictions on the types of courses that can be offered in distance learning (Chamoli, 2020). In recent times, major private players have invested hugely in online learning platforms and such are widely available in packages for all levels of learners starting from the primary. While the popularity of such commercial online platforms is projected to grow at a formidable speed over the next few years (Agarwal, 2021), it must be understood that these are still supplementary tools used to augment the understanding a student gains from his/her classroom experience. In the universities as well, e-Learning was only considered as a supportive framework for students.

The current paper presents the results of a survey conducted among engineering students to assess their reaction towards online learning. It focuses on the online content materials, interaction between students and teachers, advantages and disadvantages of online education and tries to figure out the future of online education and offline education and blended mode of learning vis a vis the perspective of students.

Objectives

The American Psychological Association (APA) defines learning as, "the acquisition of novel information, behaviours, or abilities after practice, observation, or other experiences, as evidenced by a change in behaviour, knowledge, or brain function. Learning involves consciously or unconsciously attending to relevant aspects of incoming information, mentally organizing the information into a coherent cognitive representation, and integrating it with relevant existing knowledge activated from long-term memory" (American Psychological Association (APA), n.d). Presently being advocated as a lifelong iterative phenomenon of learning, unlearning and relearning or up-skilling, psychologists Gagne, Briggs and Wager, classified this into five major categories, namely, physical skills, information, intellectual skills, cognitive strategies, and attitudes (Gagne et al., 1992). Our education institutes, namely schools, colleges and universities are expected to impart these skills, additionally imbibing in the students the ability and right attitude towards lifelong learning. The primary difference between offline and online learning lies, which incidentally is one of the two most powerful influences in the learning environment (Westwood, 2004). In the case of e-Learning or online learning the communication between the teacher and the learner is over a highly constrained medium which often creates barriers to real-time feedback which otherwise is observable to the trained eye. It is therefore justified, that the e-Learning industry has set the major goals for e-Learning (Francis, 2018):

- Enhance the quality of learning and teaching
- Meet the learning style or needs of students
- Improve the efficiency and effectiveness
- Improve user accessibility and time flexibility to engage learners in the learning process

In the current context, when educational institutes have been forced to deliver courses online, the actors involved having been trained and practiced in the contact mode of teaching-learning, the quality of delivery and approach to teaching comes under question. At the

same time, the interest and ability of the learner to learn solely from and in an environment hitherto unknown also need to be followed.

The purpose of this work was to understand the student's reaction to the paradigm shift in learning mode and the outcome of the same. The work, compiled through a survey on a sample size of 315 engineering students of the second (2nd), third (3rd) and fourth (4th) years consisted of a questionnaire covering the following aspects of online learning during the Covid-19 pandemic:

- Content delivery
- Content structure
- Teacher-Student interaction
- Efficacy
- Popular mode of learning

The actual measurement though would be revealed at a later stage when the learners' would be exposed to scenarios in real life and would have to apply the learning made during these testing times. Nevertheless, an educated prediction of sorts is attempted and reported here which can identify the course of action for academics to meet the standards set by the industry and the industry to check the correctness of the standards set.

The authors used convenience sampling through the circulation of the questionnaire via social platforms. A total of 348 responses were collected out of which thirty-three (33) responses were rejected due to incompleteness. Among the three categories, i.e. second, third and fourth-year students, the responses received were 87, 138 and 90, respectively.

Literature Review

Since its inception and years of growth, e-Learning has been evaluated from multiple angles. The comparisons, always being up against the traditional mode of classroom delivery, have been aimed at measuring the efficacy of e-Learning (James, n.d). On one hand, while researchers report that students taking greater numbers of online courses were more likely to engage in quantitative reasoning, while being less likely to engage in collaborative learning, student-faculty interactions, and discussions with diverse others and have less exposure to effective teaching practices and lower quality of interactions, it is also seen that online learning builds self-learning proficiency (Dumford & Miller, 2018). It has also been advocated to follow the middle path, i.e. to use blended mode for a better learning experience (Pineda-Herrero et al., 2011).

Considering the unprecedented situation that the world has been thrown into, the only option that the academic community was left with was e-Learning. In the Indian context, thankfully, the majority of the stakeholders were connected to the internet and therefore at least the most rudimentary education imparting could be continued. It is only to be accepted that neither the teaching community nor the educational institutions were ready for this and it took some time to get used to this new paradigm of lecture delivery. Even the learners at times found it difficult to adjust to a speaking box.

Substantial research has been reported already post the onset of Covid, deliberating into various issues impacting education. While some harp on the widening social divide and the rise in popularity and use of e-Learning platforms (Bacher-Hicks et al., 2021), some have tried to analyze the impact of online learning on the quality of learning (Dhawan, 2020)(Suryaman & Kusnan, 2020).

Multiple surveys have also been conducted among various discipline-specific students. In their work Sarwar et al (Sarwar et al., 2020) conducted a cross-sectional study using an online survey comprising 31 questions posed to a total of 1207 dentistry students across Pakistan. The results brought out the dissatisfaction of the students with almost all aspects of the institutional learning management system and the quality of learning resources available. In a global survey conducted on dermatologists, 38 per cent responded that they did not have the requisite infrastructure in place (Bhargava et al., 2021).

The drawbacks of e-Learning already have been in the knowledge of researchers and the impact has been fathomed, a direct correlation between the efficacy of e-Learning and acceptance of the same under forced circumstances needs to be understood. In the reported literature, engineering graduates' feedback or survey could not be traced. To this end, the current work puts on record the findings of a survey conducted on engineering students in India. Considering the fact that engineering students would be better equipped in handling technology, as would be the teachers, the questions were directed to be more technically aligned. Courses tagged as 'professional', like engineering, medicine, pharmacy, architecture etc, having been banned from being conducted in distance mode, this survey hopefully would be of help to policymakers and business houses alike in planning for the future of education in general and e-Learning in particular.

Data Acquired

The questionnaire for data acquisition, made using Google Forms was floated among engineering students in 2nd, 3rd and 4th years, respectively. Freshmen were excluded from the survey since they have not experienced offline engineering education as yet. The form was kept alive for a week-long period and each student was allowed a single entry only. A total of 315 unique responses were received, comprising 28.6 per cent of responses from 2nd year, 43.8 per cent of responses from 3rd year and 27.6 per cent from 4th year students. The responses represented figuratively are shown in Figures 1 to 7 and discussed in the following sections.

The questions were framed and initially tried within a closed group of 40 students. Based on feedback received about clarity and objectivity, the questions were rephrased and all questions were made close-ended.

- **Device Used**

A sizable majority of students depend on mobile phones for attending classes. Out of the total 315 responses, 189 students answered in the affirmative about mobile phones while 39.4 per cent said that they use a laptop or a desktop computer for the purpose. Figure 1.2 shows the pie-chart representation of the data.

- **Platform**

A variety of platforms have been reported to be used. While the most prevalent being Google Meet with 59 per cent usage, Microsoft Teams was the next most used platform with 24.8 per cent of students reporting using it. Other platforms like Zoom, Google Classroom and Skype are also used in lesser numbers. Some students even reported classes being conducted using WhatsApp Conference video calls. Figure 1.3 shows the students' responses.

Figure-1: Year of students, devices used, platform, network

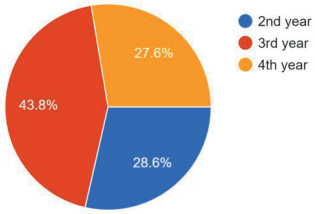

Figure 1.1 - Currently, in which year of Btech do you belong??

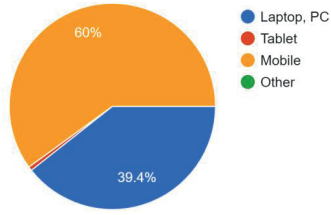

Figure 1.2 - Gadgets for attending online classes

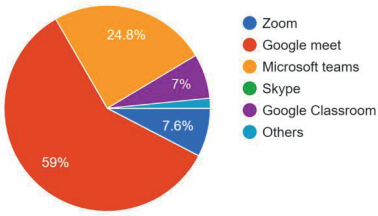

Figure 1.3 - Platform of online classes

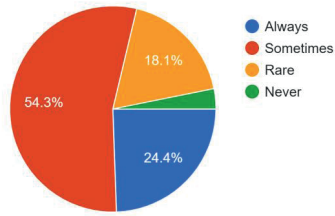

Figure 1.4 - How often do you face network issues during online classes??

- **Network**

As of 2021, India has more than 700 million internet users, comprising 41.129 per cent of its population (Keelery, 2021). However, reliability seems to be a bottleneck as user satisfaction is abysmally low. In the survey, 78.7 per cent of students reported frequent connectivity problems affecting the quality of education. Figure 1.4 shows the response plot as pie-chart.

- **Study and Lecture Material**

About 89.9 per cent of students reported getting content materials in the form of live lectures, presentations or reading materials. However, a majority, i.e. 58.7 per cent do not find the material provided to be sufficient for learning and they need to refer to other resources for their self-learning. The quality of content delivered and provided was found to be of average quality by the majority of the students comprising 42.2 per cent of students. The materials also fell majorly in the poor to average bracket for self-learning for 44.34 per cent students. Further, 43.8 per cent of students felt that not all subjects could be effectively delivered over online mode and some needed the physical presence of the teacher. Figure 2.1, 2.2, 2.3, 2.4 and 2.5 show the responses received from relevant questions in the survey.

Figure-2: Study and lecture material

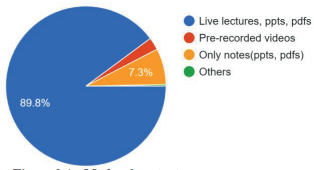

Figure 2.1 - Mode of content

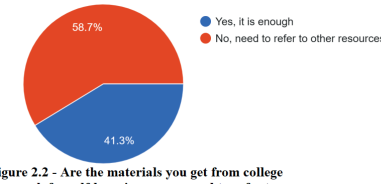

Figure 2.2 - Are the materials you get from college is enough for self-learning or you need to refer to other resources??

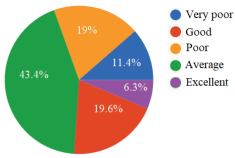

Figure 2.3 - Content understanding for students

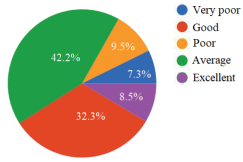

Figure 2.4 - Content materials

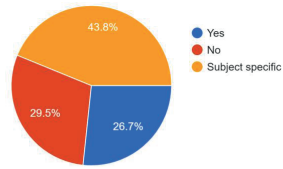

Figure 2.5 - Do you find online classes are helpful for self learning??

- **Content Delivery and Teaching Style:**

A substantial number (62 per cent) of students responded that they are aware of the fact that the teachers are unused to delivering and preparing study materials for a complete online mode of learning. However, an astonishing 51.1 per cent of students replied that they expect teachers to deliver quality comparable in style with those of professional online courses. The majority i.e. 44.7 per cent of students are happy with the syllabus coverage but a majority 43.1 per cent also graded the quality of delivery as average. Figure 3 maps the responses to the relevant questions.

Figure-3: Content delivery and teaching style

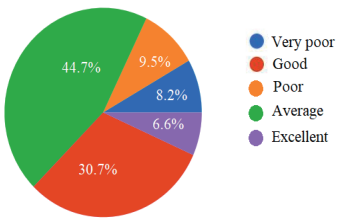

Figure 3.1 - Content delivering

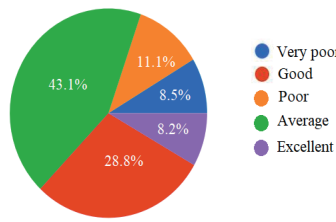

Figure 3.2 - Teaching style

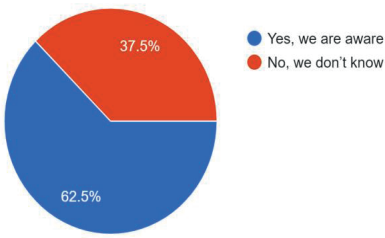

Figure 3.3 - Are you aware whether the teachers are equipped or not to deliver online lectures??

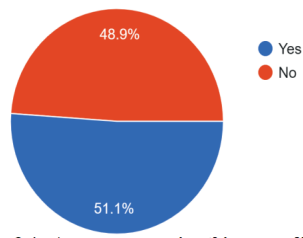

Figure 3.4 - Are you comparing this new online teaching style with that of professional style of online leactures??

- **Teacher-Student Interaction**

Unmistakably, the student's responses on teacher-student interaction are as expected. Majority of students are in denial in accepting online learning as helping in teacher-student interaction. A majority even found it easier to clear doubts in physical classrooms through questions than in online lecture sessions. Figure 4 shows the response percentages.

Figure-4: What is your reaction?

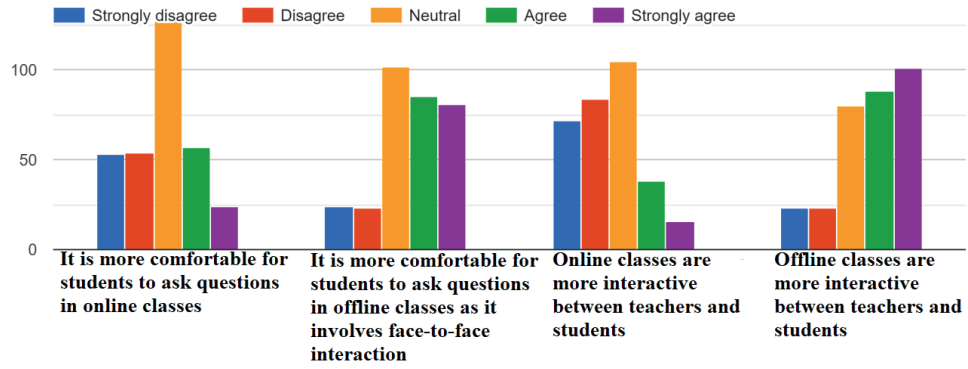

Figure 4 - What is your reaction??

- **Examinations and Results**

The recorded responses do not narrow down any concrete pattern on the number of examinations conducted. Students reported having to appear in more than one examination in a month, while some said that they have a single examination in about five months, which makes up a semester. However, irrespective of the number of examinations needed to appear in, 47 per cent of students said that their results have improved during the pandemic-induced online classes. Close to 36 per cent of students claimed that their results did not undergo any significant change, while 17.5 per cent reported having suffered during online examinations. Figures 5.1 and 5.2 show the student's responses.

Figure-5: Examinations and results

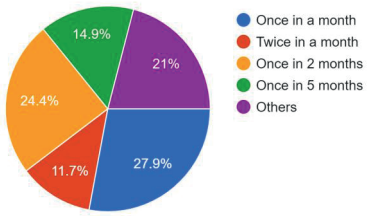

Figure 5.1 - What is the frequency of your online examinations??

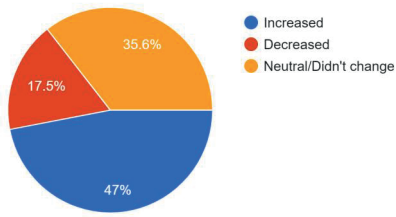

Figure 5.2 - How has your result changed from offline to online classes??

- **Advantages and disadvantages of online education**

Maximum students find the ease of being at home/comfort of home as the main advantage of online education. Interestingly, about 62 per cent of students confessed to being engaged in other activities like chatting, playing games or doing household chores while

having logged in to online classes. In the case of disadvantages, students mainly find network issues during online classes as the main difficulty. Figures 6.1, 6.2 and 6.3 show the results.

Figure-6: Advantages and disadvantages of online education

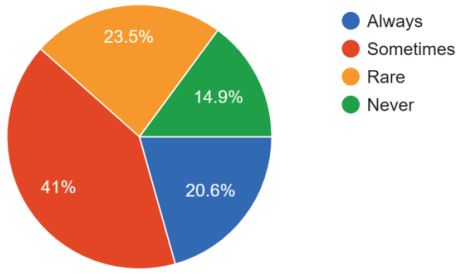

Figure 6.1 - During online classes, how often do you indulge in some other activities like chatting, household stuffs, etc??

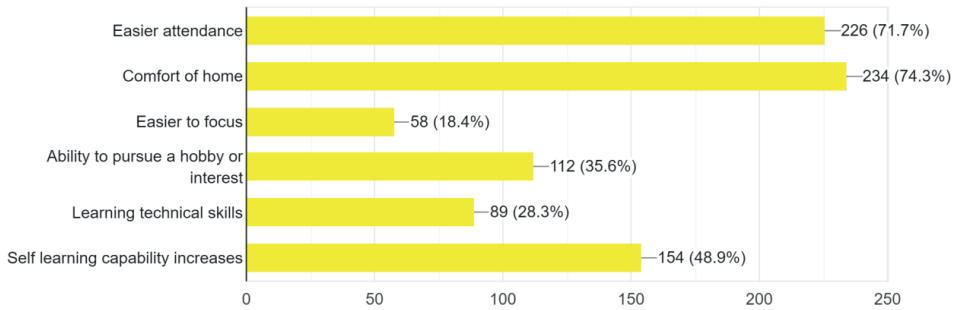

Figure 6.2 - Advantages of online classes

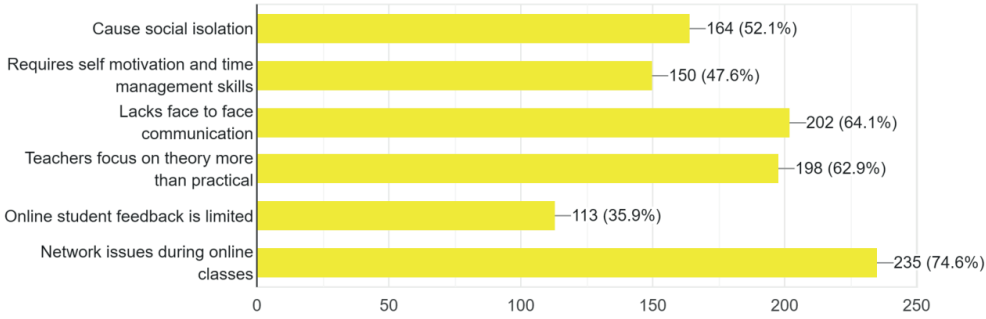

Figure 6.3 - Disadvantages of online classes

- **General Opinion**

Online learning as the sole mode having been thrust, the students have fared well. However, the majority still prefers offline mode over online learning, with 59.4 per cent of students believing that offline mode will stay for some time. Being very clear about the advantages and disadvantages, as is shown through response maps in Figures 6.2 and 6.3 respectively, a sizable number of students voted in favour of choice-based online learning, as can be seen in Figure 7.

Figure-7: General opinion

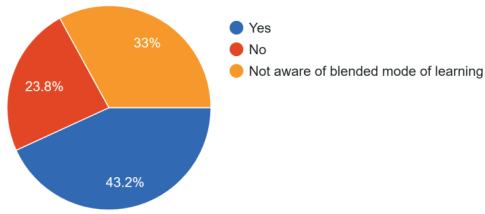

Figure 7.1 - In post covid situation, will you prefer to blended mode of learning??

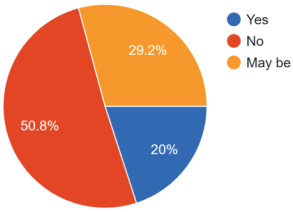

Figure 7.2 - In future, do you think that formal(school / college) education should be stopped and online education should be made choice based??

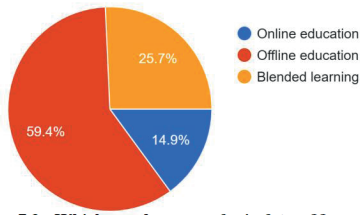

Figure 7.3 - Which one do you prefer in future??

Analysis of Responses

The results as mentioned in the sections above can be reviewed and analysed in the context of the prevailing scenario in the Indian academic context. The current section tries to bring out the underlying reasons and build upon them to provide valuable insight. The analysis is based on visualisation using graphical tools and information available in the literature.

The penetration of smartphones has grown at a remarkable pace in India. India has the second largest smartphone users globally. As of May 2021, the penetration rate of smartphones in India reached 42 per cent and was estimated to reach 51 per cent in the financial year 2025, more than doubled from financial year 2016, when only 24 per cent of mobile subscribers were using smartphones (Sun, 2021). After beating the US, recently by crossing 220 million active smartphone users in 2015. Smartphone ownership among young adults, especially college-going students has been consistently elevated (Arora et al., 2016). It therefore, is not a surprise that over 50 per cent of students are using mobile phones for attending online classes. Despite the advantages of mobile phones being the ubiquitous tool for communication, much doubt exists about its use for pedagogically valuable learning settings. It supports spontaneous short study phases and needs game-based course design for effective learning (Kramer & Strohlein, 2006). Under the existing scenario, neither the teachers nor the academic institutes are fully aware of or prepared for incorporating such changes. The problem is further complicated by the fact that a sizable population also uses laptop or desktop computer-based learning. The course delivery would have to suit either set of students both technically, catering to the operating system and display size variances for pedagogy. Ideally, this would need engaging additional manpower for the design of the interface for content delivery. The teacher is not trained for the job and can only do his bit in the content preparation. It is probably only obvious that it is for such reasons that the satisfaction level of the student with respect to the content and its delivery is low. This is substantiated through the results shown in section

4.5. Interestingly enough, students are aware of the problems faced by teachers. Additionally, the teachers, having been trained through the classical classroom teaching approaches themselves and have developed methods and mannerisms suitable for the paradigm would need to be retrained and adapt to the demands of changing times. Even after the restrictions are eased and as students come back to classes, the expectation would have changed and the community might be looking forward to what is popularly known as blended learning.

In the present context, using online learning, the attention span of the average learner has also been affected. Mobile devices and applications, being designed to engage the user's attention (Shirky, 2014), the difficulty level for the teacher increases manifold. Academia therefore needs to invest time and energy into developing a unified strategy for generalised learning methods suitable for classroom, online and blended teaching-learning. As could be assessed from the findings reported in section 4.4, content quality, delivery style and techniques need a major re-look. Also, irrespective of the kind of devices used, about 20 per cent of students (33 of 191 mobile users and 29 of 124 PC users) reported regularly being distracted by other online activities, which is a serious hindrance to learning.

Education, being not only about learning a subject but also social skills and communication, online learning is naturally hindered. Even teacher-to-student communication is constrained, proper subject-based skill imparting would also naturally be hampered. The feeling of belonging to a community, as exists in the case of a class or a fraternity feeling that normally exists among course mates, is missing in online learning. Efforts must be made by teachers and pupils alike to get deeply involved in constructing interaction and collaboration between the instructor and students and among students to create an effective online learning community (Sun & Chen, 2016).

Possibilities look bright with the advent of Augmented Reality and 3-dimensional imaging. Supporting such technologies and taking them to the end user, en masse would require a lot of investment in the infrastructure. In a country as big and geographically diverse as India, this is a challenge. The future of education in general and engineering education, in particular, rests on policies and their implementation both by the government and private sector investors.

A major drawback of the online learning phenomenon lies in the assessment of students' responses. Even more starkly evident during the pandemic, due to the sudden migration to online learning, the results of students have improved by a considerable margin. The primary reason was over-reliance on multiple-choice-based questions, the universities had no choice otherwise. Evaluating text-based answers automatically is a steep task and a method and platform acceptable to all are yet to be developed (Chakraborty et al., 2021). Advantages apart, MCQ-based tests have their own limitations and are seriously restricted in not being able to measure crucial learning outcomes like analysis, evaluation and creation. A better grade does not necessarily mean better learning, the end purpose stands defeated under such conditions.

While having improved grades may be happy news for students, it would certainly not stand in good stead in the long run and harm the interests of all stakeholders.

Conclusion

The Covid-19 pandemic has affected

all of us all too suddenly. With hardly any time to think, people have been sent indoors. Like all other walks of life, education too has been hit. In retrospect, it might be easy to criticise and find faults with the way things were conducted. However, it must be remembered that nobody was ever ready for this and no system can ever be ready for an event that forces so much change.

All odds notwithstanding, the entire academic fraternity has shown steely resolve in coming around and continuing, in ways best possible, the teaching-learning process, so that the future and career prospects of millions of learners are affected minimally. The methods employed might be flawed, but can evolve to be highly effective if properly tuned. In the times to come, when the students return to the classrooms, their expectations would have changed, and it would only be wise to adapt to the demands of changing times, even more so if that leads to improvement. The survey-based study reported herein, can be summarized through the following findings:

1. Students expect
    a) more interactive sessions
    b) better delivery
    c) study materials that suit self-learning
2. Students are aware of the advantages and disadvantages of online learning
3. The internet connectivity has to be more reliable
4. Pedagogy has to be adapted to suit blended learning
5. Teacher training is essential for changing trends in learning
6. Online examinations must be upgraded to enable more rigorous testing of learning outcomes
7. Online learning platforms need standardization

The authors hope that the results and findings would be helpful for researchers, education managers and policymakers in taking forward the teaching-learning system in India, especially in the domain of engineering education.

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