

# **Virtual Teaching Learning Practice and its Impact on Technical Courses during COVID-19: A Post Pandemic Study**

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***Abstract***

Novel Coronavirus Disease (CORONA-19) has enormously changed the traditional education patterns from elementary level to tertiary level and shifted the entire system on virtual platform. Based on Covid-19 and speculations about changes in teaching and learning pedagogies, the study examines the turning point in Indian technical education. To measure the quality of teaching technical courses on virtual mode, a survey was conducted on a total 551 university students of technical courses. The paper takes a quantitative as well as a qualitative approach to study the effect of online teaching learning program on technical courses which requires rigorous practical exposure and hands on sessions on equipment and machines with teacher. The data was analysed using structural modelling. The present research study highlights the challenges engineering students experienced during the online instruction during the pandemic period. During our research, we discovered a number of challenges that had a negative impact on online engineering education. The paper explores the impact of corona virus on engineering education and practices. The research explores that the practice of virtual platform is not effective for the subjects need experiments and hands on sessions. The result shows that it is very tough for students to concentrate for long hours in online classes and they end up getting frustrated. The result suggest that the satisfaction with online classless can be achieved as the technical courses require more hands on training sessions with machines and equipment.

**Keywords**

Distance Education; Engineering Higher Education; Online Education; Teaching online Engineering subjects, Teaching Pedagogy and changing trends

## I. INTRODUCTION

COVID-19, a virus that changed the way we live. The virus started spreading in November 2019 and now the whole world is affected by it. No one ever imagined that we have to live in an era where all of us are just homebound. The most important and initial step to prevent the spreading of the coronavirus was lockdown because still there is no cure for COVID-19. Those almost 3 months of lockdown brought a lot of changes in our lifestyle.

The entire lockdown phase just made things still. No one was able to head out for their work anymore but someday or the other things are supposed to get in place and start working with adaptations. To continue with work and education everyone around the globe started working online. Meanwhile, everyone was busy performing their work happily online, People were not supposed to get up early and rush to their workplace instead, as work from home was quite a feasible option for them but the students suffered the most. The classes that were conducted physically were now all shifted to online mode. The teachers tried hard to make their way through technology but still, it's tough for students to concentrate for hours in an online class and they end up getting frustrated. The learning offered in offline mode paved a path for students to understand concepts and implement those but online classes were not enough.

As a result of the COVID-19 pandemic, Engineering education has changed dramatically, with the distinctive rise of e-learning, whereby teaching is undertaken remotely and on digital platforms. Engineering teachers have been compelled to adapt new technology for teaching and figure out how to turn what is traditionally a hands-on education into a distant practise due to closed campuses. It is interesting to note that this crisis resulted in discovering new dimensions in online teaching of engineering courses and enabled various distance-learning tools to implement for teaching and assessment. (Khan & Muhammad, 2021). Research suggests that online learning has been shown to increase retention of information, and less time intake, meaning the changes coronavirus have caused might be here to stay. While countries were at different points in their COVID-19 infection rates, worldwide there was currently more than 1.2 billion children in 186 countries affected by school closures due to the pandemic. With this sudden shift away from the classroom in many parts of the globe, some are wondering whether the adoption of online learning would continue to persist post-pandemic, and how such a shift would impact the worldwide education market. Many universities around the world have fully digitalized their operations understanding the dire need of this current situation(Dhawan, 2020).

## II. LITERATURE REVIEW

The Coronavirus Disease 2019 (COVID-19) pandemic has caused temporary closures of educational institutions around the world, leading to the widespread suspension of face-to-face classes and cancellation of examinations. (Law et al, 2022). As the COVID-19 pandemic spreads, there has been an increasing move towards teaching online because of shutting down of schools, colleges and universities for an indefinite time as the only option left (Martinez et al., 2020). Its global spread has led to the total suspension of public education and university classes, forcing schools to revise their original education plans (Toquero, 2020). This is not the first time that traditional educational activities have been suspended in response to an infectious disease. Previously, viruses such as SARS (2004) and H1N1 (2009) adversely

impacted existing educational activities in numerous countries (Cauchemez et al., 2014). However, universities were not prepared for such a transition from classroom-based education to completely online education because of that most universities initially lacked infrastructure and strategies (Zhang et al., 2020). Empirical studies have found that students feel that they learn better in physical classrooms than through online education (Bojović et al., 2020). Online teaching and learning can take educators and students out of their comfort zones. However, it can also be used to facilitate growth through interaction with peers and encourage active participation (Furnes et al., 2018), though various pedagogical methodologies have shown efficacy in enhancement of engineering education including active learning (Lima & Andersson 2017).

Engineering education has been traditionally content-centered, hands-on, design-oriented, and focused on the development of critical thinking or problem-solving skills (Bourne et.al, 2005). Engineering education is a specific sector of the higher education. The effectiveness of teaching and learning processes in this sector is strongly determined by practical exercises, experiments and laboratory classes (Ożadowicz, 2020). The engineering students understand the engineering concepts effectively when they conduct the experiments in the laboratory. Hence, laboratory is as important as theory; however, the ill-equipped laboratory facilities affect the students' learnability (Kapilan et al., 2021). To compensate the need of the technical subject, professors are taking help of virtual laboratories to teach science courses (Ray & Srivastava, 2020). However, virtual laboratories allow students to simulate experiments related to their courses online (Diaz & Walsh, 2020); Practical experimentation assists the students in gaining experience through concrete materials, improving students' working habits and problem-solving skills, enhancing their abilities to understand practical problems and improving their attitude towards education (Gossenheimer et al., 2017), therefore, students of engineering courses need access to laboratories, technical equipment and instruments to perform practical experiments, to cooperate with each other and to acquire both technical as well as social skills associated with their technical area (Wurdinger, S., 2005). Technical skills are crucial for engineers, according to the learning by doing paradigm. Therefore, students of engineering courses need access to laboratories, technical equipment and instruments to perform practical experiments, to cooperate with each other and to acquire both technical as well as social skills associated with their technical area (Voukelatou, 2019). It is a well-accepted fact that whatever the student learns in one particular semester the application must be tried and understood before going to the next phase. When classes for various subjects can be held online, the application part which is a must for engineering studies will be greatly affected (digital learning, 2020). Students identified various challenges they experienced in online synchronous instruction of courses through Zoom including lack of peer support/interaction, focus, engagement, and clear guideline from instructors. They also indicated difficulties with time management and Zoom fatigue. Peer-support/ interaction has shown to improve the success rate of students especially those from underrepresented groups (Williams et.,al, 2017)

Many comparative studies have been carried out to prove the point to explore whether face-to-face or traditional teaching methods are more productive or whether online or hybrid learning is better (Lockman & Schirmer, 2020; Pei & Wu, 2019; González-Gómez et al., 2016; González-Gómez et al., 2016). In an era of technological outburst, the methods of providing

education, especially engineering education, to present and future generations need to be changed dramatically to make engineering graduates ready to tackle the challenges posed by a world which promotes rapidly accelerating changes. (Bhat & Sathyendra, et.al, 2019). Pandemic has caused educational loss, delayed graduations, cancelled internships and lost job offers. The new generation of students who have been away from face-to-face instructions may lack certain learning experiences. For example, there might be a generation of engineering students who performed the majority of their lab activities virtually and thus, lacks true hands-on skills. (Asgari et al., 2021) There is considerable literature comparing distance education and face-to-face offerings, mainly based on student success in evaluation measures, student attitudes, or overall student satisfaction (Phipps R Merisotis, 1999), while one cannot propose a single assessment method that would work ideally for all engineering courses and classroom sizes, it would still be interesting to study how various online exams and assessment methods (e.g. online quiz tools within the LMS, open-book or take-home examinations, student presentations, peer-reviewed activities, cooperative quizzes. (Slusser & Erickson, 2006) The on-line learning environment adds to the difficulty of the professor's task because students are expected to delve into the abstract and complex issues related to the theoretical basis of a profession without the spontaneous give and take of the face-to-face seminar. (Cragg et al., 2008), Urgent, careful and evidence-based planning is needed to mitigate the impact of pandemic on engineering education especially for vulnerable, disadvantaged and underrepresented students facing substantial challenges beyond their academic responsibilities, including family obligations, financial burden and additional employments. (Rofifah, 2020)(Saw GK, Chang C, 2020). Additional efforts need to be taken to guarantee that the online instruction of engineering courses still meets the rigorous requirements of the program accreditations. (Shadnaz et al., 2021).

### III. DISCUSSION AND OBSERVATION

#### A. *Need of technical subjects/domains and how online classes fulfil their requirements.*

Technical subjects are moreover practical-based subjects. Technical subjects focus on learning through practical knowledge and how this knowledge can be transformed into practical models. These technical subjects do require to build problem-solving abilities and measures how efficiently students can implement theoretical knowledge into practical ones. Online classes do not fulfil the complete requirements of technical subjects/ domains, although Virtual labs and various software have been introduced to demonstrate the technical aspects but they are only limited to computer screens and cannot be performed practically. According to a study practical and hands-on demonstration helps students in better understanding of concepts and these domains need to be tackled separately through offline practices.

Most of the modern professional institutions hold as their major criteria of enrolment to be the mandatory communication skill. However, the most significant question lies in whether the present syllabus of the technical institutes' supplements for the requirements of the technical sectors as far as communication or technical exposure is concerned. The prevalent educational system puts stress on having high marks in aggregate and the professional Institutions along

with their teachers only represent such content to the student that would help them in scoring high marks all through their semester examinations. This factor is often creating significant difficulties in the development of true professionals as the system judges the capability of the students entirely based on their marks obtained in each of the semester examinations rather than how much they are ready to fit in any industry or organization. According to Prakasam (2011), the adult learners are capable of learning better, when they are represented with content related to the requirement of industry experience and if they feel like the associated creators of the obtained knowledge along with the textbook and the teacher.

In this context, one of the major issues that need to be elaborated is the area of curriculum design. Particularly in Indian context, most of the engineering colleges are linked with the state technical university. The university has compulsory section to perform, learn and get practical exposure. The syllabus in each syllabus targets some distinctive skills that a student must acquaint. The same gets fail when comes in online platform as a student does/can perform and learn.

Choice Based Credit System (CBCS) was introduced by RGPV in 2015. Enhancement of writing and reading skills is one of the opportunities provided by this new system and in this audit course (Communication- HU 111) the students are required to read a substantial amount of literary work so that they can present a review on it. Although this factor could be beneficial for the in-depth training of the students in the language, the newly designed syllabus is creating difficulties. During the span of 90 working days, the teachers get limited time to teach the students sufficiently and respond to their individual needs. Especially considering the late admissions in private technical institutions, low attendance factors relating to holidays and medical leaves, unexpected holidays, etc. it can be said that the limited scope of imparting viable knowledge is further shrunken. Added to this, the overall disparity in the knowledge base of students makes the job of imparting viable knowledge even more complicated.

There are many tasks that need to be addressed in this blended period, these may include, completion of the syllabus in each semester, developing communication skills, strengthening the base of subject and most importantly preparing future engineers for the corporate world. Especially if the private technical institution in question is under private management, the teachers go through a significant amount of pressure that derives from the higher authorities. These expectations from the teachers also incorporate impressive results and performance by the students they are responsible for.

### *B. Future of technical courses through online classes*

The future of technical courses through online mode is quite deceptive. Technical courses/domains may be learned if extensive software is built up to shape student's minds and enable them to apply practical knowledge into their lives. Through proper guidance and availability of great resources, technical subjects could be learned with ease in the mere future, but if there is no such provision these subjects/domains cannot be learned to the fullest.

*c. The same curriculum in offline and online mode creates a gap*

Schools and universities design or make necessary changes in curriculum every academic year that needs to be followed for the proper functioning of education institutions. It ensures the topics to be covered in time, the exams are held on time, and various other aspects. Before lockdown, the education was offline, therefore the curriculum was designed as per the situation which included practical sessions, interactive activities etc. But even after classes being switched from offline to online, the curriculum remained same. Keeping students focused, making sure they build collaborative skills, and making sure they aren't losing interest can be daunting. This caused real struggle for science and math-based classes, as students struggled with a lack of in-person experiments and engagement. Online classes paved a path for different curriculum as many aspects varied from offline to online mode. This created gaps in the learning process.

The fact to believe that we spend more time in making notes and other assigned work in online classes than in traditional learning. The reason behind is that it is a text based learning and to establish dialogue you have to type a message or you have to guess. Further you have to spend more time in reading as it is slower than speaking, is a drawback of online learning. Even you are likely to forget more in while a lecture is being delivered which is a human nature. Thus we may learn more in online learning but with a greater effort.

#### **IV. RESEARCH GAPS:**

A. *Lack of motivation and attention* - Distance teaching is difficult for teachers, but it is likely far more difficult for students.. Student's moved from classrooms where learning is explicitly encouraged to bedrooms and kitchen tables where distractions abound and expert assistance isn't always available. It's understandable that some people will be tempted to opt out.

B. *Lack of concentration for long hours in online mode*

Students are not able to focus for long hours in an online class and become less attentive as no one is monitoring them. Also, sitting in front of a screen for a long time causes a lot of problems, be it eye irritation, headache, etc. In classrooms learning, the respective teachers are liable to provide the students with feedback on real time basis, it is at the exposure of students that they are facing certain issues related to their teaching and learning process. In this process the respective students can get their issues resolved in between the lecture or at the end of the lecture, with personal intervention of the teacher in the spare time. In some of the institutions, some amount of time is allowed as 'free time' to meet the difficulties of said students. Here it is important to mention that morally it is the duty of every teacher to meet the study related grievance of the students. On the other hand if the teacher is able to provide personalize feedback on the progress of the student then this goes in the favour of the student as well as teacher, apparently this is going this is going to increase the motivation of the students to a substantial level. In case of online learning, student feedback is very important but then again in the present times, agencies are striving of the same on real time basis. There are certain apprehensions of the students who have completed all the assignment and met the assessment

needs of the given institutions i.e. the process of student feedback cannot be considered as 100% viable and base for making certain decisions. As far as the online learning system is concerned, previous methods are not suitable to make the real assessment of teacher and overall teaching and learning system. After the advent of COVID-19 more than 90% of the educational institutions are imparting education over online mode and many of the professional institutions are having their own 'Learning Management System' that is complete in all respects as per the discretion of related agencies. Some of the institutions are having inbuilt system of feedback but then again it is not sure that to what extent the respective feedbacks are taken into consideration and what action are taken on the basis of the same.

#### *C. Decreased learning*

In offline classes, students actively took part in all discussions and this helped them retaining knowledge. Online classes show a different scenario, nobody knows what assignment given to them is about. They just concentrate on completing those rather than learning and applying concepts.

Online learning is a theoretical mode of learning that's why can be performed in online platform. The same is very hard to learners to get involve in practical sessions as, it is equally required to learn and develop. There are subjects like physics, chemistry, biology etc. related to science and technology that require student available there to perform practical to enrich his/her level of learning. On the contrary traditional learning caters motivational surrounding and come up with a blend of both practical and theoretical form of learning. Dissimilar to online learning, traditional learning enables students to experience overall cerebral and skill development.

#### *D. Missing link (communicational skill development) in online learning*

As far as academic knowledge of the students is concerned, online teaching methods are meant to be a better approach for the same. On the other hand it is also considered that improvement in the communication skills of the students is difficult on online mode. It can be considered as a matter of the learning system and also as a matter of mere negligence. As a matter of fact there are many interpretations of the same i.e. the students are not getting ample opportunity to exercise communication learning with the peers and friends, minimum opportunity of communication with the respective teachers, and even with the associated team of the process.

#### *E. Lack of accreditation & quality assurance in online education*

Though online learning has been considered as an authentic and effective platform than classroom learning, the same need to be ensured whether each online institution must have qualified and accredited faculties and approval. Validation of the learning system is altogether a different prospect i.e. some of the other kind of the affiliating agency is required to be engaged in the same, this affiliation can be considered in the light of study material, efficiency of learning system, quality of the learners and teaches associated in the same. Here it is important



to mention that a inferior quality system can ruin the overall thought process of the management and it will be difficult of the stakeholders to assess the qualitative aspects of the same.

*F. Online instructors tend to focus on theory rather than practice*

Many of the online platforms are engaged in the process of online teaching and learning, as a matter of fact many of such platforms are very good but the fixation of quality is altogether a different prospect. In most of the it was observed that the teachers or the trainers are focusing on theoretical aspects of the same and respective practical aspects neglected. This is because of the reason that the theoretical portion of the same is easy to replicate and hard to explain in practical terms. With this awareness, educators need to deliver a positive and innovative experience for every online student. Educators must consider different approaches to online design and development that considers mobile responsive. The goal is to create mobile friendly visual framework that allows for comprehensive viewing in all online environments. (Catherine W. Cook, 2014). Hence it can be stated that if the teachers and learners are not in direct communication then it is hard to impart the knowledge of the same.

*G. E-Learning is Limited to Certain Discipline*

This is a well-known fact all the teaching and learning systems are not fit for online processing i.e. in some of the cases it might become difficult to impart education and knowledge with the learners. Social sciences, humanities are the favourable fields of online learning but then again engineering, medical, etc. are difficult enough to be processed on online platforms. As a matter of fact practical knowledge is in the core of all such knowledge. This overall system of learning may change in future, but then again for time being this will remain different in all respects.

*H. Lack of Course Structure*

Although curriculum introduced for Offline as well as Online system are one and the same but there are lots of gap we observe in both the systems. Theoretical parts do not make any impact but practical aspects of curriculum leave a large gap in the overall performance of the education system under online system. For the students belonging to Science stream, practicals become an ignorant area and the sanctity of experiments and the inferences out of it leave the whole knowledge as an incomplete version of our degree.

*V. INTERACTION WITH TECHNICAL DOMAIN*

The coronavirus pandemic has generated changes in the teaching-learning process in higher education institutions and has influenced the interaction between teachers and students. As a consequence of the pandemic, universities were constrained to carrying out their activity with students exclusively online. (Claudiu Coman, 2020). Technical subjects make the students skilled and technically fit for their fields. Technical education train the students perfectly for their industry and also increases their potential. This paradigm shift could generate changes in students' perception of this way of teaching and their perception might be different from the one found in studies previous to the pandemic. (Claudiu Coman, 2020). Online classes provide the students with the online simulators where all the lab experiments can be performed and also the sites that fulfil the requirements for technical graphics and drawings. Even with these

facilities, students are not able to grasp the entire topic because most of these activities require physical and proper assistance to perfect their skills. These topics are new to the students and doing them online does not help them to take over the subjects. With the upgrade in technology department, technical courses will be reformed to better virtual experience for students which might help the students to understand better but there's no guarantee that these courses online will make the students experience what they would have if they were physically present in the campus. online education has become a viable component of higher education in engineering subfields such as electrical and computer engineering, computer science and information technology especially at the master's or post-graduate level (Martínez PJ,2019), however, engineering education has been traditionally content-centered, hands-on, design-oriented, and focused on the development of critical thinking or problem-solving skills. (Bourne J, 2005)

## VI. LEARNERS BEHAVIOUR

Due to isolation many issues came into existence when moving offline to online learning, how does one provide informal social interactions, how to ensure student attention, or even how to ensure active participation? Most schools or other institutions struggle with these issues since neither their teaching material addresses this nor have they had training on this as of course this was a hectic change for them too. Isolated life includes psychological, social and economic consequences, and its implementation which requires the support and supervision. Due to this epidemic, various problems brought a massive change in student lives and so it did in the education sector. The pandemic has led education institutions to move all face-to-face (offline) courses online across the globe. A new normal has been created and it is teaching online.

## VII. QUESTIONNAIRE QUESTIONS

S.No.	Questions
1.	The quality of learning experience in online courses is better than inn face to face courses
2.	Online classes allow dynamic interaction among the student themselves.
3.	Online classes provides innovative and creative approaches of teaching learning.
4.	Technical subjects are effectively being taught through online classes
5.	Online classes give enough exposure to comprehend technical knowledge of technical subjects.
6.	All technical subjects impart knowledge matches with the expected outcome.
7.	All subjects suffice the purpose of hands on sessions.
8.	Teaching technical subjects through online classes inculcate the habit of experimentation.
9.	Teaching technical subjects through online classes excel the orientation towards collaborative active learning through technology.
10.	The teacher is well versed with the course content of the assigned classes.
11.	The teacher actively involved in teaching courses through online classes.

12.	The motivates students for the out of box thinking through online classes.
13.	The teacher effectively enables to linkage theories with practices though online classes.
14.	The students equally getting an opportunity to learn requisite skills of employability through online classes.
15.	Accessibility of e -learning resources strengthening the curriculum through online classes.
16.	The course objective matching with learning outcome through online classes.
17.	The course outcome matches with students outcomes through online classes.
18.	The course curriculum need to be updated/modified for the online classes separately.
19.	Students are attentively attending online classes.
20.	Students are attentively responding to the teacher in online classes.
21.	Students are able to learn independently with teachers during or after online classes.

## VIII. RESEARCH DESIGN AND APPROACH

Science has its particular methods that are supported by several methodologies. The approaches that have been used for social science methodology are qualitative, quantitative and mixed methods. The qualitative approach involves several methods which are a case study, ethnography, grounded theory, phenomenology and many other methods. On the other hand, the quantitative approach involves several methods such as observation, regression analysis, power analysis, hypothesis testing, multilevel modeling, data analysis, re-sampling, meta-analysis and random controlled trials. There has been the development of the combination of qualitative and quantitative research also which has been termed as ‘quant-qual’ research.

Research has vast areas to cater to and cannot be confined to any limited space or field. Research is not limited to science and technology; there are several areas to which research can be done including sociology, history and languages. The research should be active, systematic and detailed so that it can successfully determine as well as understand the facts, behaviors and existing theories. Research and development also refers to applying the outcomes of research to refine the other related subject and improve the lives of humans. To complete the research, the parameters required are observations, analysis, experiments, comparing and reasoning. Multiple regression analysis along with analysis of variance and linear regression, and its main regression statistical parameter. has been used here to predict the outcome of online teaching and learning skills.

## IX. BRIEF OVERVIEW OF THE RESEARCH PROCESS

The brief overview of the present research process is described below that is used for conducting the research. In the below listed points the researcher has tried to mention the stepwise journey i.e. defining the research, problems faced during the research, research proposal and strategy, defining hypothesis, research design, objective of research, collection and sampling of data and its analysis and its representation on graphs and tables.

### IX. OBJECTIVE OF THE STUDY

The main objective of the study is to investigate the effectiveness of online classes of technical undergraduate B. Tech students. The significance of the study is to prove the importance of the offline classes which cater the need of the technical subjects.

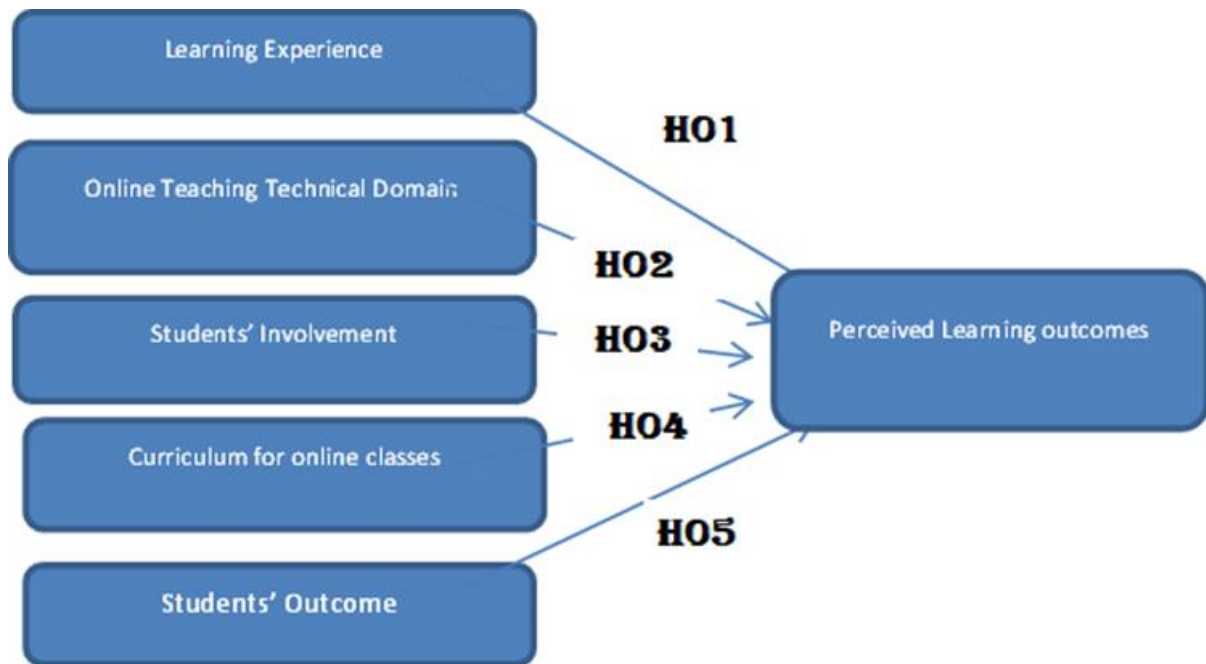
To complete the study, three hypotheses are designed and examined to determine which hypothesis is accepted and which should be rejected.

1. To determine technical learning outcomes through online classes.
2. To explore the factors this may impact the learning outcomes of the technical courses through online classes.
3. To identify the various psychological impacts of online classes on learners and instructors.

### X. STATEMENT OF HYPOTHESIS

- H01: Technical learning experience has no effect on Online Learning.
- H02: Technical education has no effect on Online Learning.
- H03: Students Involvement has no effect on Online Learning.
- H04: Curriculum of Technical Education has no effect on Online Learning.
- H05: Students' outcome has no effect on Intention to use Online Learning.

### XI. CONCEPTUAL FRAMEWORK



Traditional learning is fully equipped with instruction and the medium where teaching style has been advanced. Traditional learning always has multiple benefits that can't be attained through online learning (Xu and Jaggars, 2016). There is one more thing that face to face learning is more multidimensional. It really caters to real time experience and the directions which lead students to a variety of questions and reasoning that can be implemented into it followed by a convincing response and explanation by the teacher (Salcedo, 2010). Over the period of time, though, online learning has improved and will bring new aspects of learning.

However, the traditional form offers multiple learning features that cannot be found in online learning. (Kemp and Grieve, 2014).

To cater better learning of students we have to ensure that the curriculum implemented in traditional and online learning should not be the same as there is no impact of the theoretical part on practical facets. There is a big gap in the overall development of a student when he/she undergoes two different forms of learning i.e. online and traditional. Since the students belong to a technical background and practical learning is very much an essential part, it becomes an ignorant area that leads as an incomplete version of their degree (Jenkins, 2015). To perform better in online learning and retain students there should be a high quality curriculum followed by course introduction and instructor. An online course must cater real time interaction to students with cognitive learning. It must recommend each aspect like purpose, structure, pre-requisite and other aspects.

## **XII. SAMPLING DATA COLLECTION**

Sampling refers to the method in which appropriate samples have been selected that represents the part of the population. The main function of this method is to determine the constraints of the entire population. Data of 700 students from the universities of technical courses across India have been collected by using simple random sampling. The research is purely qualitative. SPSS 20 version software to code and analyze the data set. Data collection refers to the procedure in which information has been gathered and measured based on particular variables of interest that have been developed systematically and allows the individual to share their opinion based on asked questions and their responses are then evaluated to reach the outcomes. The primary data that had been used in the study is the first hand and fresh information that was collected from the respondents directly. The sources that had been used for collecting the primary data are a questionnaire, observation check sheet and a schedule prepared with appropriate formats. In this research, the method that had been used for collecting the data was a structured questionnaire which has been taken during COVID -19. The sample is collected from Government as well as private technical universities across India, to give the maximum representation to the sample for the better result of research.

## **XIII. DATA ANALYSIS**

### **Q1. Summary of Analysis of online Learning Experience**

**Table 1.1: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.657 <sup>a</sup>	.431	.428	.901

a. Predictors: (Constant), 2,3,4,5. (Refer to Table -1)

The value of the adjusted r square is 42.8% this percentage shows that 42.8% of the variation in the student's output of online classes is good but the remaining 57.2% score is due to other predictors that are not included in the model or other uncontrolled factors.

**Table-1.2**  
**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	430.256	4	107.564	132.565	.000 <sup>b</sup>
	Residual	567.985	700	.811		
	Total	998.241	704			

a. Dependent Variable: 1.

b. Predictors: (Constant), 2,3,4,5. (Refer to Table -1)

The p-value or sig. value = 0.000 which is less than 0.005 and highly significant the f- test reject the null hypothesis that states Learning Experience has a positive effect to use Online Learning.

**Table-1.3**  
**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	.147	.116		.408	.002
	2.	.371	.035	.367	10.727	.000
	3.	.173	.036	.170	4.767	.000
	4.	.161	.036	.166	4.476	.000
	5.	.127	.040	.125	3.209	.001

a. Dependent Variable: 1.

Here the constant = 0.147 is the estimate of  $\beta_0$ . Which has a sig. = 0.002 which is highly significant.

## Q.2 :Summary of Analysis of Online Technical Education

**Table-2.1**  
**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.589 <sup>a</sup>	.347	.344	.965

a. Predictors: (Constant), 6,7,8,9.

The value of adjusted r square is 34.4% this percentage shows that 34.4% of the variation in the students output of online classes is good but the remaining 65.6% score is due to other predictors that are not included in the model or other uncontrolled factors.

**Table-2.2**  
**ANOVA<sup>a</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	346.791	4	86.698	93.159	.000 <sup>b</sup>
1 Residual	651.451	700	.931		
Total	998.241	704			

a. Dependent Variable: 1.

b. Predictors: (Constant), 6,7,8,9.

The p-value or sig. value = 0.000 which is less than 0.005 and highly significant the f- test reject the null hypothesis that states Technical education has positive effect to use Online Learning.

**Table-2.3**  
**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.055	.140		-.397	.003
6.	.197	.043	.172	4.609	.000
1 7.	.351	.042	.310	8.437	.000
8.	.074	.038	.073	1.977	.048
9.	.200	.040	.193	5.024	.000

a. Dependent Variable: 1.

Here the constant = -0.055 is the estimate of  $\beta_0$ . Which has a sig. = 0.003 which is highly significant.

### Q.3 : Summary of Analysis of Students Involvement in Online Teaching

**Table-3.1**  
**Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.509 <sup>a</sup>	.259	.253	1.029

. Predictors: (Constant), 10,11,12,13,14.

The value of adjusted r square is 25.3% this percentage shows that 25.3% of the variation in the students output of online classes is good but the remaining 74.7% score is due to other predictors that are not included in the model or other uncontrolled factors.

**Table-3.2**  
**ANOVA<sup>a</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	258.158	5	51.632	48.765	.000 <sup>b</sup>
Residual	740.083	699	1.059		
Total	998.241	704			

a. Dependent Variable: 1.

b. Predictors: (Constant), 10,11,12,13,14.

The p-value or sig. value = 0.000 which is less than 0.005 and highly significant the f- test rejects the null hypothesis that states Students Involvement has positive effect to use Online Learning .

**Table-3.3**  
**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.541	.173		3.130	.002
10.	-.143	.055	-.120	-2.624	.009
11.	.150	.057	.125	2.615	.009
12.	.037	.054	.034	.694	.488
13.	.176	.050	.160	3.524	.000
14.	.373	.042	.365	8.933	.000

. Dependent Variable: 1.

Here the constant = 0.541 is the estimate of  $\beta_0$ . Which has a sig. = 0.002 which is highly significant.



**Q. 4: Summary of Analysis of Curriculum Change for Online Teaching Technical Education**

**Table-4.1  
Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.535 <sup>a</sup>	.286	.282	1.009

a. Predictors: (Constant), 15,16,17,18.

The value of adjusted r square is 28.2% this percentage shows that 28.2% of the variation in the students output of online classes is good but the remaining 71.8% score is due to other predictors that are not included in the model or other uncontrolled factors.

**Table-4.2  
ANOVA<sup>a</sup>**

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	285.656	4	71.414	70.153	.000 <sup>b</sup>
Residual	712.586	700	1.018		
Total	998.241	704			

a. Dependent Variable: 1.

b. Predictors: (Constant), 15,16,17,18.

The p-value or sig. value = 0.000 which is less than 0.005 and highly significant the f- test reject the null hypothesis that states Curriculum of Technical Education has a positive effect to use Online Learning .

**Table-4.3  
Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.248	.187		1.325	.0012
15.	.093	.042	.087	2.228	.026
16.	.229	.053	.202	4.333	.000
17.	.350	.051	.314	6.909	.000
18.	.046	.039	.038	1.158	.247

a. Dependent Variable: 1.

Here the constant = 0.248 is the estimate of  $\beta_0$ . Which has a sig. = 0.0012 which is highly significant.

## Q. 5 : Summary of Analysis of Student's outcome in Online Teaching

### 5.1 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.525 <sup>a</sup>	.276	.273	1.015

a. Predictors: (Constant), 19,20,21.

The value of adjusted r square is 27.3% this percentage shows that 27.3% of the variation in the students output of online classes is good but the remaining 72.7% score is due to other predictors that are not included in the model or other uncontrolled factors.

### 5.2 ANOVA<sup>a</sup>

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	275.546	3	91.849	89.091	.000 <sup>b</sup>
Residual	722.695	701	1.031		
Total	998.241	704			

a. Dependent Variable: 1.

b. Predictors: (Constant), 19,20,21.

The p-value or sig. value = 0.000 which is less than 0.005 and highly significant the f- test reject the null hypothesis that states Students' outcome has positive effect on Intention to use Online Learning.

### 5.3 Coefficients<sup>a</sup>

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	.676	.124		5.456	.000
19.	.297	.045	.310	6.668	.000
20.	.111	.046	.112	2.415	.016
21.	.208	.036	.208	5.745	.000

a. Dependent Variable: 1.

Here the constant = 0.676 is the estimate of  $\beta_0$ . Which has a sig. = 0.000 which is highly significant.

## **XV. DESCRIPTIVE ANALYSIS:-**

Using descriptive analysis, we determined that measuring the effectiveness of online learning is effective, seeing that out of 700 responses, students aged 20-25 filled this survey, and only 41% of the responses belonged to postgraduates. 94.6% of respondents had taken online courses, while 5.4% had never done them. Some respondents had to pay the amount to do courses, where 37% paid more than Rs.1000, and 37% had taken free courses. Most respondents know online platforms such as Microsoft team (84.9%) and Zoom (78.6%). Respondents consider some criteria before enrolling in an online course. There are several criteria that determine suitability for courses, including content, price, time, adaptability, and skills. Fewer than a quarter of respondents said they do not have any issue with online platforms, 32.9% face communication barriers, 27.6% face content issues, and 27.1% face visualization problems. We asked them about the connectivity and found that 55.3% of them were using 4G Internet while 34.2% were using Wi-Fi, where some (78.3%) were also experiencing connectivity issues due to the weather conditions (57%) and having trouble with SIM signals (52.7%) that are located in rural areas, and 10% are experiencing problems with the mobile version. Some of them, (63.2%), also see a change in their behaviour concerning using online learning in terms of technical enhancement and improving communication. Overall, (56.1%) are satisfied with online learning, whereas (27.4%) are confused, and 58 (16.5%) are not satisfied.

In the past two decades, we have been migrating from offline to online learning, and many educators are exploring the utilization of digital media and technology in the classroom. Despite the fact that they live in a digital era, many students still rely on chalkboard instruction. Through online learning, students can access videos, presentations, texts and tutorials to learn concepts. Studying online is easy, flexible, and convenient, which makes online learning much more preferred. Online learning has only one drawback: there is no face-to-face interaction between the student and the teacher. A traditional education helps a student become more interactive and disciplined. Online learning can be a boon to students seeking higher education with some changes.

## **XVI. UNCONTROLLED FACTORS AFFECTING ONLINE TEACHING**

A well-established instructional medium, classroom teaching, has refined its teaching style and structure over a period of several centuries. A face-to-face course has a number of benefits that its online counterpart cannot match. Firstly, and perhaps most importantly, classroom instruction is highly dynamic. Traditional classroom teaching involves real-time face-to-face instruction and sparks new questions. Additionally, teachers can immediately respond to students' questions. Firstly, and perhaps most importantly, classroom instruction is highly dynamic. Traditional classroom teaching involves real-time face-to-face instruction and sparks new questions. Additionally, teachers can immediately respond to students' questions. Online teaching slows down the learning process because students must confine their queries to blurbs and then give the teacher and classmates time to respond. On the other hand, online teaching is likely to develop with time, boosting classroom dynamics and bringing students face-to-face

with their classmates and professors. However, face-to-face training offers dynamic learning characteristics not seen in Web-based instruction for the time being.

## **XVII. RESULT AND DISCUSSION:**

As per table 1.1 to 5.3 we can see that from above interpretation of the table as shown. We can easily claim that online teaching is not suitable for the higher level of education. As per the data set and respective analysis our null hypotheses have been accepted. It is clearly visible as shown in the data analyzed in Table 1.1 that traditional learning do have more impact on students than online learning. While as per the next table, one can understand that there is a greater difference in learning experience in traditional learning than online learning. Meanwhile if we have an eye on the output of students, there is almost a difference of two times ratio of students in both of the learning platforms.

## **XVIII. SUGGESTION & CONCLUSION**

Research demonstrates certain deaths such as the weakness of online teaching infrastructure, the limited exposure of teachers to online teaching, the information gap, non-conducive environment for learning at home, equity and academic excellence in terms of higher education. Based on the data analysis, we came to the conclusion that the online classes for technical subjects are not very effective. The research also shows that the offline classes are found more interactive and effective for technical subjects as for its practical needs. To improve the quality of online teaching, an interactive session must be held between teacher and students every week that just focuses on different attributes and problems faced during lectures. Long lecture hours should be cut down and divided into small periods so that students can concentrate for maximum time in those short lectures. After every topic or chapter, students should form groups and discuss the various concepts. This can also be done in the form of group activity so that it helps students in grasping the concepts easily. These were some of the gaps that need to be fulfilled but these cannot be confined within this topic as we move on, we find more pros and cons of online classes. To stay safe, online classes are a better alternative to offline or no classes at all because learning shouldn't stop.

## **ACKNOWLEDGEMENT**

The author thanks to all participants who responded on the questionnaire questions.

## **ETHICAL STATEMENT**

No funding was received for this study.

## **CONFLICT OF INTEREST**

Authors declare that they have no conflicts of interest.

## **DATA AVAILABILITY**

All the data set used in this research paper are available from the corresponding author upon request.

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