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Engineering Students Perceptions of Tool Based Instructions for Engineering Chemistry: A Case Study During Covid

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ABSTRACT

The covid pandemic had evolved a new era in academia. This global disruption led educationists to deliver lessons online with minimal or no formal training especially in Indian education system. This is a qualitative study about the contextualized instructing and learning approach during pandemic and its impact on the teacher and the students perception about tool based approach in Indian set up with participation of 161 engineering students of different branches of three engineering colleges. These cohorts were not used to even blended learning platforms. This instructional strategy was gauged by collecting survey responses, focused interviews and instructors observation at the end of the course. It expects to increase the understanding of inclusion of tool based instructions to scaffold the students learning and teachers instructing based on CoI framework. Statistical data was analysed through SPSS with Cronbach's alpha of 0. 892. The mean score, t and p values revealed a higher number of students affirming the positive impact of face-to-face approach, the inclination of students to include tool based instructions partly in the curriculum and which tool was most opted. This learning process transformed the instructors' and students' views on online teaching and its productiveness, nevertheless its challenges and made the instructor ready to leverage online instructions even after pandemic, including elements of cognitive, social, teaching presence, based on student responses and instructors' observation.

Keywords: Face-to-face approach, COVID, tool-based approach, engineering chemistry, community of enquiry.

I. INTRODUCTION

The global arena has been totally reformed due to COVID, all facets of life at all levels and professional platforms came to stand still. Whilst the world was adapting to the 'new normal' educational sector got the most hit, teachers had to shift for face to face input to online deliverance on emergency basis. The curriculum at engineering colleges include engineering chemistry course for different branches of first year engineering. This study includes 161 engineering students of the from different branches of engineering. The Students cohort is not used to enrolling and taking courses which are taught solely online or even blended. Traditional face to face classes were conducted for half semester and half of lab work and one midterm was completed after which pandemic precautions were practiced. University board announced continuation of the classes solely online and instructor used tool based instructions and assessments. Second midterm and quizzes were also conducted online. This continued for following academic year. It is worth exploring to compare students' understanding of concepts through online and face to face classes and also their performance after the online classes. Interestingly the students attendance was for online classes was in the range of seventy five to eighty percent which is almost the same online and offline. This paper is about students' perception of tool based learning approach and comparing its effectiveness with face to face classes and added to this,its about which free online tool was the most accessible and learner friendly in order to realize academic goals during the pandemic. The instructors developed effective strategies to enhance online learning and further encouraged deep learning by engaging students in different tasks through different features of the freely available tools to empower them with necessary skills and motivate them. This process transformed instructors and students

view on online teaching and learning and also made them ready to leverage technology in their educational experience. Also, this was the situation of other instructors teaching the same course and this can be proved effective in opening a path to formulating some effective online activities and initially partly introducing effective elements of blended instructions for engineering students in chemistry course.. The effectiveness of this approach was studied using survey and conducting interviews with students at the end of semester and also on teachers observation and In recent times, almost every institution of higher education blends e-learning programs with the usual curriculum. (Zawacki-richter & Qayyum, n. d.) However, refinement in the strategies could be done based on student evaluation and instructors observation. And also higher authorities intervention in making best online resources available can provide greater opportunities of effective teaching and learning.

The main purpose of this research is to examine students' experiences with the use of instructional tools enabled learning environments for engineering chemistry course. What were the benefits, challenges and to know scope for blending face to face classes with tool based approach for attaining certaing learning outcomes in both theory and lab part of engineering chemistry. Statistical data was analysed through SPSS(Reynolds, n. d.). Interestingly, results revealed a higher number of students affirmed the positive impact of face-to-face approach. The results of this report are meant to inform teachers' teaching and learning practices if they are creating community of inquiry through tool based approach. With respect to this research purpose, this study addressed three questions:

(a) What are the perceptions of students about tool based instructions when compared to face-to face approach?
(b) For the engineering exams which approach best prepares the students face to face or online tool based or blended?
(c) Comparing the different instructional tools used and also which had advanced features and security?
(d) Recommendations and limitations of tool based approach.

II. LITERATURE REVIEW

COVID-19 spread extremely fast, disease carriers were contagious and remained symptomless for a number of days, the initial symptoms was mistakenly treated as a normal flu, the virus wase fatal, particularly for the elderly and people with chronic illness, and as of May, 2020, there was effective treatment ...Because of these characteristics, countries could not take a "wait and see" approach (Weng, Ni, & Ho, 2020). This situation was a governance challenge which was responded after some wait, by announcement from university board as a statement to carry out regular online classes using appropriate tools. Therefore instructions were given using online tools exclusively for the remaining semester.

This pandemic period has given the instructor space to practice education technology exclusively. Pandemic responses of the government and universities had forced the teacher community relied on tools like zoom, google meet, cisco and so on for conducting online classes. The colleges and universities had no prior arrangement or plan for conducting online classes exclusively. Teachers have tried to use technology in teaching and learning as Marla states that the focus is on tools that are readily available to most classroom teachers, practical to learn and use, and free or inexpensive. (*Choosing Technology Tools to Meet Pronunciation Teaching and Learning Goals*, 2018). Further the author concludes that technology cannot replace teachers, nor is it necessarily better than, or even as good as, traditional instructional methods. [We should] treat technology as one tool among others. and also Thus online distance education has moved from the periphery into mainstream higher education. (Seaman, 2014)There are blended or online learning courses in higher education, however, the outcomes with reliable indication should be made available to the institution management, teachers and students.

For example, teaching methods have changed from classroom classes to blended learning classes where students can take classes anytime and anywhere(Kim, 2018) It was observed that there existed a significant difference in the scores of students who were learning in ICT integrated classrooms and the students who were studying in traditional classrooms. (Dosaya et al., 2018).

It is important not just to use technologies but assimilating it to the teaching methodology is also important for a system to be rated as successful. (Panthallor, 2019)

For a course like Chemistry for Engineers which has 100 marks for theory and 75 marks based on lab work, it is indeed a challenge to solely use tool based instructions for theory and impossible to conduct lab classes. This research deals with the encounters that boiled off during this unique semester-with face to face classes and other half was synchronous and asynchronous tool based approach and the following two semesters where the teaching was exclusively online followed by a semester of blended teaching. This research would suggest that computer conferencing has considerable potential to create a community of inquiry for educational purposes. (Garrison et al., 1999). The theory has the three overlapping constructs of social, teaching and cognitive presences, and has the student learning experience at the heart of the three. However, social presence is now the central construct of the framework. (Armellini & Stefani, 2016). For this research

CoI elements were used. That is, authors looked for indicators of cognitive presence, social presence, and teaching presence in teaching and learning. Community of Inquiry Coding Template was also used.

ELEMENT	CATEGORY
Teaching presence	(1) Instructional management; (2) Building understanding; and (3) Direct instruction
Interpersonal relationships	(1) Emotional expression; (2) Open communication; and (3) Group cohesion
Comprehend	(1) Triggering events; (2) Exploration; (3) Integration; and (4) Resolution

Table 1: The Coding template for the 3 dimensions Adapted from (Garrison et al., 2001)

III. METHODOLOGY

3. 1. Materials and Procedure

This study was conducted at Lords Institute of engineering and technology includes as part of the curriculum "engineering chemistry" for different branches of first year engineering. The population under study includes 161 engineering students of the three different engineering colleges. The Students cohort is not used to enrolling and taking courses which are taught solely online or even blended. The students learnt engineering chemistry for half semester through traditional face to face classes. The first internal assessment and more than half of lab experiments were completed before the covid-19 pandemic. Emergence of covid-19 pandemic forced the remaing half of theory portion of the course to be completed entirely online through freely online available tools. Following two semesters were completely online and then one semester it blended learning. Technological tools used for the online classes used did facilitate learning as seen by the lens of behaviorism learning theory, cognitive and constructivism learning theories of Edtech. For example short assignments were given on google forms which facilitated quick analysis and follow up. This task is supported by earlier research that assignments are reinforcements and reinforcement is key to successful transfer through behavioristic learning (Mims, n. d.). Lectures were organized and structured notes were given to enhance learning maps and thus facilitate cognitive learning. All this was done for planning and conducting instructional design. There was visual, audio learning reinforced by digital multi media. This is indicated in other works where the author says Taking into account students‟ concepts, misconceptions, modes of thinking, and responses, these teachers accordingly shift their teaching methods or content when needed. and that Educational technologists need to ensure that these meaningful and relevant practices are accessible and used to promote learning about critical literacy and identity, which are so important for contribute, reshape, and enrich the educational experience(Amarin, 2017).

3. 2 Instrumental design

The study took into consideration 2 tools to collect data, questionnaires were employed for primary investigation and also to gather quantitative data. Added to this to increase rigor and validity of the results interviews were conducted. On one to one basis or in a small group of 2-3 participants with necessary precautions and also on zoom conferencing. The survey questions were devised with 18 open ended questions on 18 Likert scales. (1- strongly agree to 5- strongly disagree) followed by 6 open ended questions purposely inducted to gauge the effectiveness of tool based teaching and learning compared with that of face-to-face. The 5 interview questions had content which was inclusive of the theme of the research paper. Interviews and focus groups remain most common methods of data collection in qualitative research(Gill et al., n. d.). The questions underwent rigorous scrutiny, drafts, and finalised by the author before the implementation. One thing was particularly obvious – it takes time, effort and money to select an unbiased sample; yet all this investment will be squandered if one fails to design clear, relevant, meaningful and unambiguous questions for eliciting the desired information from selected respondents

3. 3 Population data collection

The survey was sent to the 161 participants via their personal email ids and the announcement was made on the class whats app group and context, directions reminders were sent. Some students also enquired about the survey by making phone calls to the instructor. The data was collected over a period of 20 to 25 days giving ample time for students and their confidentiality was respected. The results were viewable immediately through a browser with a simple refresh. In some instances due to delay in submission the instructor also called on the participants to complete the survey and submit. Success can be begun by recognizing the standard understanding and doing actions (White, n. d.). This was also done in the present research. Further, the questions and responses could easily be used to produce web-based reports through ASP(Cooper et al., 2006).

3. 4 Statistical data

Statistical data was analysed through SPSS(Rahman & Muktadir, 2021). Interestingly, results revealed a higher number of students affirmed the positive impact of face-to-face approach and interviews supported the idea of including tool based learning to some extent.

3. 5 Tools based platforms

An important aspect in instructional design is to understand media behavior. It is important to focus on how the media reaches the target group and addresses the needs of the students. (Zawacki-richter et al., 2015). Online tools used for teaching in the period of pandamic were ZOOM, CISCO WEBEX, Google Classroom. Although each tool had it's limitations as free account holder, it became imminent to switch between different platforms. An overview of each tool which was important instructing platforms during COVID period is illustrated below

GOOGLE Classroom and Google meet	CISCO WEBEX	Zoom
Many useful features tapped were Sharing notes, assignments and conducting tests. The feature which was highly useful was that assignments could be drafted and could be edited or posted on a later date. Students learning was enhanced by adding videos in assignments and questions related to videos were asked. The purpose of this was to introduce students to useful links and make them used to online platform for learning. PDFs of notes were shared. Google Forms surveys were used to take their opinion regarding teaching and learning.. Grades of tests were exported to Google Sheets and responses analysed and followed up.	Students and teachers knew that this tool was safe with stronger privacy. So the researcher switched from zoom to cisco after 3 weeks. The most useful feature which was available in CISCO and not in other apps was that students were not able to annotate without the hosts permission at that time. The most useful feature was that class could be conducted by this tool.	In the beginning weeks students and instructors were concerned about the data privacy and security issues, so there were recommendations to switch to other tools. Eventually it was announced that zoom has become safe and secure with stronger privacy. Added to the above the lectures could be recorded by any one participating in the class, making the lectures available for students reference anytime. The drawback was maximum limit of 100 participants. But it did not matter as there were only 59 students in the course. The most useful feature was that class could be conducted by this tool.

Table 2: High lights of online tools used for instructional deliverance.

IV. FINDINGS

STATISTICAL ANALYSIS

One of main purpose of this research is to examine students' experiences with the use of instructional tools enabled learning environments for engineering chemistry course. With respect to this research purpose, this study addressed three questions:

A. What are the perceptions of students about tool-based instructions when compared to face-to face approach?

In order to measure the reliability of the items on this questionnaire, Cronbach's alpha is calculated based on the scores of 161 respondents. **Cronbach's alpha** is the most common measure of internal consistency, which measures how closely related a set of items are as a group. Technically speaking, Cronbach's alpha is a coefficient of reliability (or consistency).

Reliability Statistics

Cronbach's Alpha	N of Items
0. 892	17

Table 3

Question	Mean	Median	Mode
Q4. I was asked more questions in online classes than face to face class.	2. 99	3. 00	2
Q5. Online chemistry classes helped me develop English language faster than face to face class	2. 97	3. 00	3
Q6. Online chemistry classes improved my scientific vocabulary faster than face to face class	2. 93	3. 00	2
Q7. Online chemistry classes helped me observe and understand the diagrams better than face to face class	3. 08	3. 00	3
Q8. Online classes improved my understanding of writing chemical formulas and reactions better than face to face class.	2. 86	3. 00	3
Q9. Online classes helped me to follow solving of numericals better than in online class	2. 96	3. 00	3
Q11. My online classes experience has increased my opportunity to access and use information	3. 27	4. 00	4
Q12. Chemistry course became more attractive online then face to face class	2. 71	3. 00	2
Q13. Do you think face to face classes best prepare you for final chemistry OU exam?	4. 15	5. 00	5
Q14. Do you think only online classes best prepare you for final chemistry OU exam?	2. 33	2. 00	1

Table 4

SPSS reliability analysis is used to calculate this reliability coefficient and value of Cronbach's alpha is 0. 892, which indicates a high level of internal consistency for the scale with this specific sample. (Note that a reliability coefficient of 0. 70 or higher is considered “acceptable” in most social science research situations.)

Demographic Analysis

The descriptive statistics clearly indicate that the average ratings for face-to-face instruction are higher than the online instruction.

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Q1. In general, how satisfied were you with your face to face classes part of chemistry course?	4. 42	161	0. 811	0. 064
	Q2. In general, how satisfied were you with your online part of Chemistry course?	3. 44	161	1. 336	0. 105

Table 5

Paired Samples Correlations shows the bivariate Pearson correlation coefficient (with a two-tailed test of significance) for each pair of variables entered.

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Q1. In general, how satisfied were you with your face to face classes part of chemistry course? & Q2. In general, how satisfied were you with your online part of Chemistry course?	161	0. 035	0. 662

Table 6

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Q1. In general, how satisfied were you with your face to face classes part of chemistry course? - Q2. In general, how satisfied were you with your online part of Chemistry course?	0. 981	1. 539	0. 121	0. 742	1. 221	8. 091	160	0. 000

Table 7

Above are three tables: **Paired Samples Statistics**, **Paired Samples Correlations**, and **Paired Samples Test**. **Paired Samples Statistics** gives univariate descriptive statistics (mean, sample size, standard deviation, and standard error) for each variable entered.

From the results, we can say that:

- The mean score for the face-to-face classes part of chemistry course is higher than the online part of Chemistry course (4. 41 > 3. 44)
- Overall satisfaction ratings for face-to-face classes part of chemistry course and online part of Chemistry course are very weakly and positively correlated and are not significant (r = 0. 035, p < 0. 662).
- There is significant average difference between Overall satisfaction ratings for face-to-face classes part of chemistry course and online part of Chemistry course. (t = 8. 091, p =0. 00 < 0. 05).

We may conclude that the overall students are more satisfied with the face-to-face classes part than online part of Chemistry course. (Ali, 2021)

Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Q13. Do you think face to face classes best prepare you for final chemistry OU exam?	4. 14	160	1. 165	0. 092
	Q14. Do you think only online classes best prepare you for final chemistry OU exam?	2. 33	160	1. 282	0. 101

Table 8

Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	Q13. Do you think face to face classes best prepare you for final chemistry OU exam? & Q14. Do you think only online classes best prepare you for final chemistry OU exam?	160	-0. 293	0. 000

Table 9

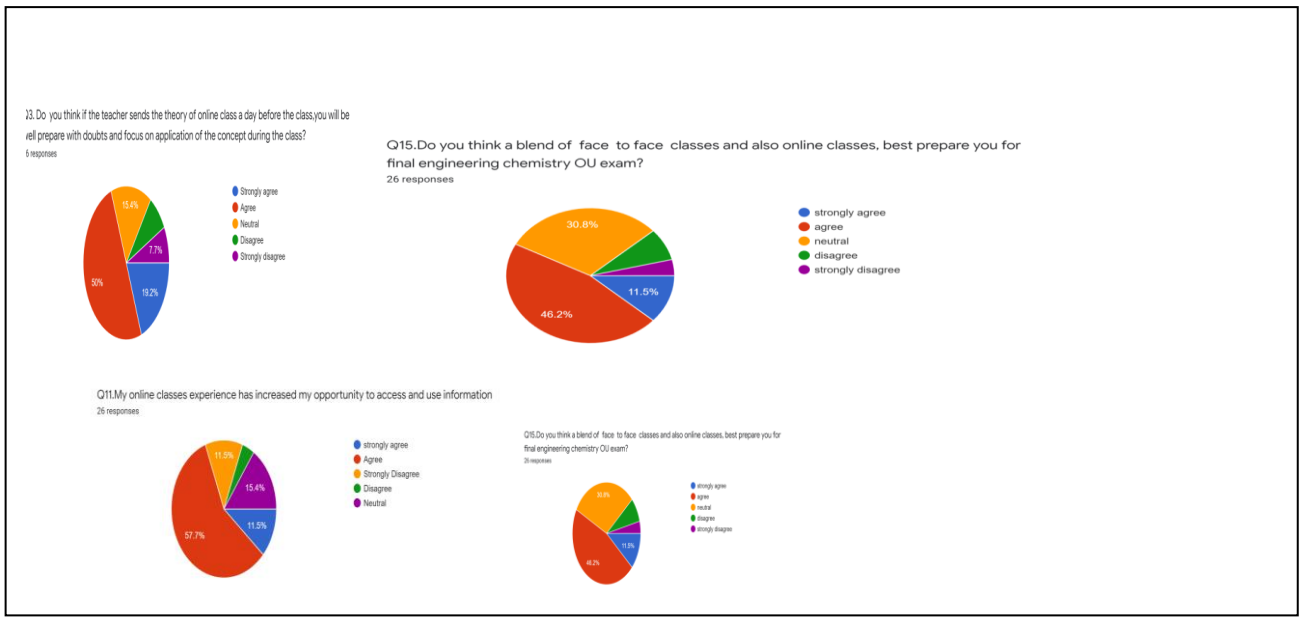
Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower	Upper			
Pair 1	Q13. Do you think face to face classes best prepare you for final chemistry OU exam? - Q14. Do you think only online classes best prepare you for final chemistry OU exam?	1. 813	1. 969	0. 156	1. 505	2. 120	11. 644	159	0. 000

Table 10

From the results, we can say that:

- The mean score for the question, Do you think face to face classes best prepare you for final chemistry OU exam is much higher than the Do you think only online classes best prepare you for final chemistry OU exam (4. 14 > 2. 33)
- Overall satisfaction ratings for final exam preparation during face-to-face classes and final exam preparation during online classes are weakly and negatively correlated. (r = -0. 293, p < 0. 000).
- There is significant average difference between satisfaction ratings for final exam preparation during face-to-face classes and final exam preparation during online classes. (t = 11. 644, p =0. 00 < 0. 05).
- We may conclude that the students are more satisfied for semester end exam preparation during face-to-face classes as compared to online classes of Chemistry course.



Pie charts of students responses to some questions.

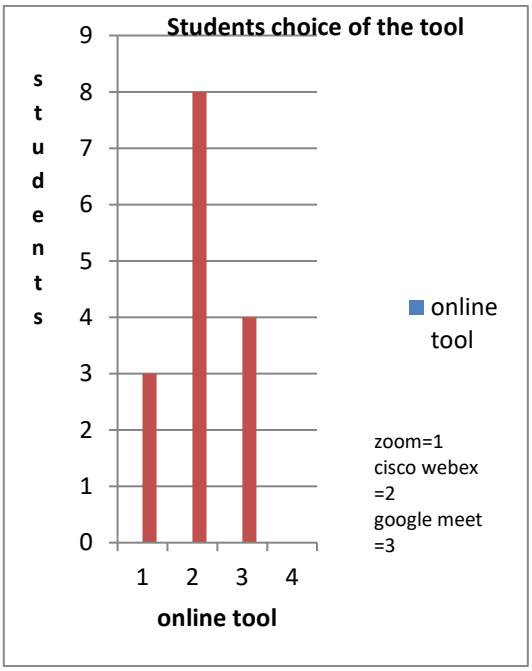


Table 11

INSTRUCTIONAL DIMENSION	STUDENTS RESPONSES	• The presentation was exceptionally comprehensive at a stable pace eventually. • Deliberately reduced the speed of instructing. • text was well structured and included colorful diagrams,3d also, which were easy to comprehend. • content was updated. • practice of the portion taught must be more frequent during the class. • class was the best in the experience with tool based approach. • initially only audio class was taken. • face-to face instructions are far better, effective and impactful. • lecture notes was not taken by students due to no time provided for it. • 50% agreed that if the teacher sends the theory of online class a day before the class, it will prepare to focus on application of the concept during the class. could find all teachers notes in one place and it was not messy.
	TEACHER'S EXPERIENCE	• Learnt and implemented ways to derive attention from the students ▪ took couple of classes to get adjusted • encouraged students feed back from time to time during each class. ○ recognized the students' level of understandings of the course. • had to prepare soft copy of the notes. • typing complex equations and structures of polymers was exhaustive. • The speed of instructing was adjusted according to feed back. • got to know the best practices even from students. • worried about the security issues initially. • Experienced the instructional difference and challenges. • Teaching was less stressful than face to face class and amusing, • Showing diagrams from different sources and 3d also was easy. • teaching was more creative and attractive. • white board markers were not flexible.
LEARNING DIMENSION	STUDENTS EXPERIENCE	• have increased their opportunity to access and use online information. • helped them understand writing formulas and reactions better than face to face • understand solving numericals better through online classes than face to face. the quality of education not comparable to face-face classes Interpretation of chemical structures became easier. • could improve English vocabulary better in online class than in face to face • helped me develop English language faster than face to face class • more questions in online classes than face to face class. • got observe and draw diagrams better than face to face. • improved scientific vocabulary faster than face to face class • helped me observe and understand the diagrams better than face to face class • improved my understanding of writing chemical formulas and • reactions better than face to face class. • Pictorial representation was clear. • learning better from text potrayed on the screen. • learning became clear and deep
	TEACHER'S EXPERIENCE	• novel ways of motivation were applied and more emphasis was given to know if students were following. • suggestion was to instruct to take notes during the lecture. • The students were at times disconnected, indicators of learning were missing. • 10 % of students drastically showed interest in the course. • deep learning is seldom successful, depends on situation and understanding level of student test, online quiz was easy to conduct and evaluate. The students learning enhanced by posting videos followed by related questions. • The outcome of the tasks and tests really were not fair as the question paper was sent to students email id 5 minutes before test and they were instructed to scan and send immediately after the exam time. • Students were promoted to next semester but the final exam of this semester is due. The exam results would reflect effectiveness of tool based classes better than the midterm 2.

		• students becoming independent learners is a challenge in this approach. self-disciplined students are concentrating and succeeding in learning.
COMMUNICATIVE/SOCIAL DIMENSION	STUDENTS EXPERIENCE	• The audio transmission wasn't steady when communicating. • But making it successful can be done if we had any app where we could not only study but also share our feeling which could only be done in a face to face class • could not ask questions due to hesitation • social interaction issues. • lacked the zeal and enthusiasm to study sitting away from each other. • interact with every student to keep them engaged was a challenge. • classes could be recorded by students. • people need to be safe throughout COVID time, online learning and social interaction among students is the best. - More group activities should be conducted. • much attention was given by the teacher. • zoom meeting was ending in 40 minutes and the students had to rejoin again. • the classes kept students engaged • issue appears of audio and wifi signal decided how effective the teaching was. Students had connectivity issues and had to be accepted in class more than once rendering the locking the meeting option not so useful.
	TEACHER'S EXPERIENCE	some minutes were allotted to read out attendance in order to make them attentive. • The individual students names were called on in intervals and their involvement in discussion was done to create learners community. students mics were opened from time to time to take responses. • class management involved mic control of participants and their video control. • chat box was used to give any individual instructions or send message to every one. • announcements were made by chat box. • Choice of words was deliberately made to develop social interaction. • agreed that the amount of their interaction with the instructor improved. • agreed the amount and quality of their interaction with other students improved. • initially, was not sure if student is really present or has frozen the screen. • teacher realized the importance of discussion boards. • Initially one outsider joined the class. Later each student was directed to use their roll numbers while entering the class.

Analysis of responses from google forms and elements of Community of Enquiry(CoI)

The outcome demonstrates the differences in the learning and teaching impacts on the students and the teacher experiences of the tool based and face-to face approaches. The table is indicative of the fact that that the two approaches were poles apart in terms of interaction and tool based approach depended on uncontrollable factors like wifi, students discipline and also availability of proper softwares. Training of instructors through workshops, seminars and orientation of the students can increase the effectiveness of tool based approach academically. Interesting outcome of this is,it gave creative opportunity to the teachers and also, solely online mode of classes have increased students opportunity to access and use online information. Out of the free online tools CISCO WEBEX came out to be the most popular based on interviews.

Vl. DISCUSSIONS AND CONCLUSIONS

In previous works tool based instructions goal was to achieve student learning. Unfortunately, there's no single formula that guarantees learning(Valiathan, 2002). The tool based approach did provide a platform for synchronous learning and engaged the students. Instructional dimensions can be achieved by a well trained instructor. However the cognitive and social dimensions face major challenges in tool based approach. It was revealed in the study that enhancing a sense of assemblage is among the key obstacles of e-learning. The results highlighted the importance of uplifting the degree of social engagement and cooperation in order to come up with such a culture (Shlossberg & Cunningham, 2016; Wang & Hu, 2019). SPSS reliability analysis is used to calculate this reliability coefficient and value of Cronbach's alpha in the questionnaire used is 0. 892.
Most vital conclusion from interviews was that virtual environment can be used to scaffold the mainstream face-to-face approach to enhance cognitive, social and instructional elements. Use mentoring/coaching as a tool. Learners needed someone to talk to after the class who could help them with problems they encountered in the field. Using a coach, graduates of the face-to-face program were able to ask questions and those questions enabled the coach (classroom instructor) to improve the face-to-face classes(Training, n. d.). Technology tool such as zoom, Cisco WebEx and Google Classroom were vital for online teaching and

learning communicative path of deliverance of the lessons.
An important outcome was also that tool based approach alone cannot create community of learners, but can only enhance the experience of the teachers and students in the need of an emergency situation such as this pandemic. The spss analysis supports this fact as the mean score for the face-to-face classes part of chemistry course is higher than the online part of Chemistry course (4. 41 > 3. 44). other important conclusion was that face to face classes best prepare students for semester end chemistry university exam is than online classes as the mean score is (4. 14 > 2. 33).
However usage of appropriate softwares could enhance the tool based experience of teachers and students and help attain targetted goals. Teachers should practice different methodologies of instructions as different students learn through different ways.

The outcomes of instructional, social and cognitive dimensions of teaching and learning got horizontal platform in face to face approach and greater participation, interaction and cohesion and other categories of creating a community of learners were in process. In tool based approach controlling the process by the instructor became less effective. Classroom management was done by muting the mike, ironic to what is done in face to face class. Added to this students were asked to on the video from time to time some times.. The teachers instantaneous encounter of different intelligencies, nervousnous and so on of the students is lacking in tool based approach. What excited students is assignments and quizzes on google forms which were related to uploading syllabus
(theory and lab) related videos and students were asked to answer related questions which were based on Blooms taxonomy. Posting videos based on lab experiments made by the instructor too helped them understand the concepts but the development of various skills
While learning technologies and delivery media continue to evolve and progress, one thing is certain: Organizations.. academic favor blended learning models over single delivery mode programs(Technology, n. d.). Hence, this is a study of importance in that it provides higher institution, teachers and students with an knowledge to assimilate tool based approach as one of the methodolities. In reality, tool based approach can scaffold mainstream education and can be selectively used in curriculum deliverance of certain topics, activities, assessments and discussions in both theory and lab part of engineering chemistry course. Online learning appears to be a classic disruptive innovation with the potential not just to improve the current model of education delivery, but to transform it(Clayton et al., 2011). To create meaningful learning experience allowing applicable moments of student learning, several instructional strategies are suggested: matching instructional level to students' competency level, use of identical elements between learning and application settings (Baldwin & Ford, 1988) (Lim & Morris, 2009). Implications of this research is to find out those parts of curriculum- selective topics, activities, assessments both theory and lab which can be effectively delivered using tool based approach in order to implement the course to have positive effects on students from a learning perspective.

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