Traditional vs E-Teaching Learning Due to Covid-19: A Case Study for Mathematics Course

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Abstract : As the trend towards E-teaching learning strengthens,questions remain unanswered with the effectiveness of online learning in comparison to traditional classroom learning. The aim of this paper is to analyze the impact of online and offline (conventional method) teaching method on student's learning achievement. This article outlines a case study of E-teaching vs traditional teaching learning of a Mathematics course to first year engineering students within their respective programmes. The results of study are analyzed using bar/pie charts. Comparison between online teaching and traditional teaching has been done for various parameters related to students' interest for online/offline teaching, interaction with students, students' comfort level, instructor's competency etc. related to teaching and learning. The findings generate insights which help to understand the benefits and shortcomings of online/offline teaching consequently helping in improved design of such courses.

Keywords : Online Learning; Offline Learning; Covid-19; Learning tools; Technology.

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1. Introduction

The Covid-19 pandemic was largely unpredicted and having a severe impact across the globe, including educational institutions which had to stop traditional teaching. Lockdowns during this pandemic led to rethinking and replanting of courses from offline to online. (Patrick & Powell, 2009) state "online learning has the potential to transform teaching and learning by redesigning traditional classroom instructional approaches, personalizing instruction and enhancing the quality of learning experiences". Teachers were unaware about what innovations and resources to be used for effective online teaching. It is indeed a great challenge for all teachers and students alike, who are accustomed with offline courses in colleges/universities. An intuitive content layout and latest educational technologies (Video / audio / mixed) are required for a good online course. Various institutions like IIMs, IITs are already equipped with modern educational technology infrastructure to conduct online courses smoothly, whereas many other institutes are still struggling for the same. However, within a short span of time, many educational institutions have made all the arrangements for conducting online classes. Various modes of communication including the development of email groups, the interaction via apps like WhatsApp / Telegram, portals for education like Google Classrooms and the web-based video-conferencing tools (Go to webinar, WebEx etc.) are being used. There seems to be no shortage of academic valuable online resources. Good quality learning material,

interaction with learners, scalable and consistent follow-up are key goals for success in online courses (Chang & Fang, 2020) . In their research paper (Sun & Chen, 2016) analyzed 47 past findings and put together practical guidelines for those seeking to build online courses so that they can make the right choices at the implementation level. Furthermore, some studies were planned to understand the viewpoint, attitudes and preparation of the students about online classes being conducted at the university level (Lall & Singh, 2020) . The pandemic offers an opportunity to see how quick and far-reaching public and private educators can strengthen e-teaching learning, which can alter students perception about education in the future(J. Butcher, 2020). Blended learning is the blend of traditional teaching as well as E-teaching as shown in Fig. 1. A model for affordable access to effective education through national interactive online learning platforms was also proposed and assessed by (Chirikov et al., 2020) . According to them blended teaching produces similar learning outcomes for students at significantly lower costs than traditional in-person instruction. The effect of blended method and conventional method on student learning achievement was examined by (Setyawan, 2019). Some reports ends with five high-impact Online Learning concepts: (a) High correlation between online education model and enhance student learning, (b) Efficient transmission of instructional knowledge digitally, (c) Suitable resources provided to the students by teachers and teaching assistants; (d) High-quality engagement to boost student learning, and (e) Contingency strategy for addressing unforeseen online educational network instances (Bao, 2020) . (Patil et al., 2017) emphasized on effective use of MOOC courses for self -learning. A research by (Singh et al., 2012) aims to estimate the efficiency of students taking online courses in comparison to the performance of students participating in offline courses, which is also an important aspect to work upon. (Yen et al., 2018) conducted a three-way study of face-to-face, online, and mixed teaching methods in the undergraduate and developed a two-factor model defining face-to-face engagement and learning on demand (flexibility) as deciding factors for student academic outcomes. According to research (Mukhtar et al., 2020) , there are several reasons to the success of online learning that include remote learning, security, usability, though limitations comprise ineffectiveness and the difficulty in preserving academic integrity and also in designing any course or curriculum, student's preference and perception should be at the top priority.
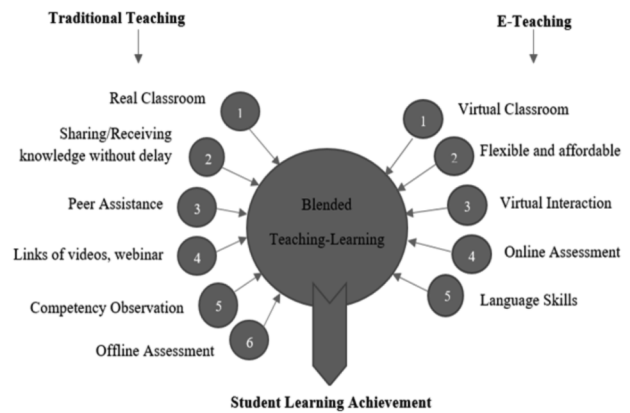

Fig. 1:Blended teaching-learning for students' achievement

Blended learning can be the best solution for the problems prevailing in our teaching process to some extent if it is implemented in an appropriate way.

Different studies have been carried out during the Covid-19 pandemic, where it emerges that various institutions have accepted and investigated the institutional structure of virtual educational programs, and are doing well with this new learning environment. (Kumari et al., 2017)compared the benefits and drawbacks of both modes of teaching (classroom teaching and online teaching) and the grade points obtained by students before and after online teacher training were analyzed statistically. (Chang & Fang, 2020) summarized the feedback from online teachers and examines the challenges and strategies associated with online learning and training. Many surveys were conducted with the aim of better understanding how faculty and students transitioned from offline to online mode of teaching and learning (Deshmukh et al., 2021). But no survey has been done to understand the issues faced by students while learning a particular course, which motivates us for this study. Different courses have different challenges in online/offline mode. Mathematics plays a key role in all the curriculum of educational programmes. It is a general perception that Mathematics is considered as a difficult subject to learn. Therefore, more deliberation is required to keep the students active in class which is difficult to follow when students are located remotely and attending online classes. Keeping the aforementioned points, we compared traditional teaching with online teaching of the mathematics course in our institute, where students were taught in the traditional way (which includes lecture delivery using blackboard

along with Presentations (PPTs) and peer assisted learning strategies) till the outbreak of the pandemic Covid-19 and afterwards they were taught through online platforms as it was need of the hour. The results are visualized using bar diagrams and pie charts to analyze the impact of both methodologies on the student learning.

2. Description Of Engineering Mathematics Course

The course Engineering Mathematics is a major basic course offered in year-1 for all BE students. The course is divided in two parts, Engineering Mathematics-I in odd semester (August -December) and Engineering Mathematics-II (January -June) in even semester. Engineering Mathematics-II is offered for 60 hours and is a 5-credit course, consisting of topics like Fourier series and transformation, Ordinary and Partial differential equations and their applications, Complex analysis, Laplace Transformation with almost equal weightage in terms of duration and awards. The course is structured to be application-oriented for each topic. Application oriented assignments are given to the students on a regular basis and assessed continuously. Students appear for their closed book examination at the end of semester and grades are assigned based on the end term examination and internal marks obtained throughout the semester.

3. Methodology

A study has been conducted at the end of the semester to collect the information from the students enrolled in the Engineering Mathematics-II course. An incisive analysis, based on a questionnaire layout, was performed by 338 Computer Science Engineering students. The questionnaire was created in Google form and the link was shared to students through WhatsApp group. Generally online courses are oriented towards self-paced learning. But due to widespread impact of Covid-19, most of institutions have switched to online teaching to ensure uninterrupted learning. Online learning is flexible and asynchronous, yet it is important to observe its outcomes in comparison of traditional face to face learning. Therefore, with the objective of making online Mathematics teaching more effective, about 22 questions related to offline and online teaching were framed which includes student's preferences for learning Mathematics course (online or offline), structure of class, Instructor's competency and content

delivery, student's comfort level, preferred way of clarifying their doubts, duration of class, interaction with peers and evaluation system. The responses to these questions have been evaluated on a 5-point continuum scale (five mean very strongly accepted and one means very strongly rejected). The collected data is interpreted using excel and demonstrated using bar/Pie charts.

4. Result And Discussions

Students' preferences around their interest in learning the subject, through online and offline mode, have been taken on five-point scale separately, as depicted in Fig. 2. In online teaching, 31% and 36% of students favor online courses strongly and adversely respectively whereas 78% and 8% of students are strongly and adversely in favor of offline teaching for learning this course.
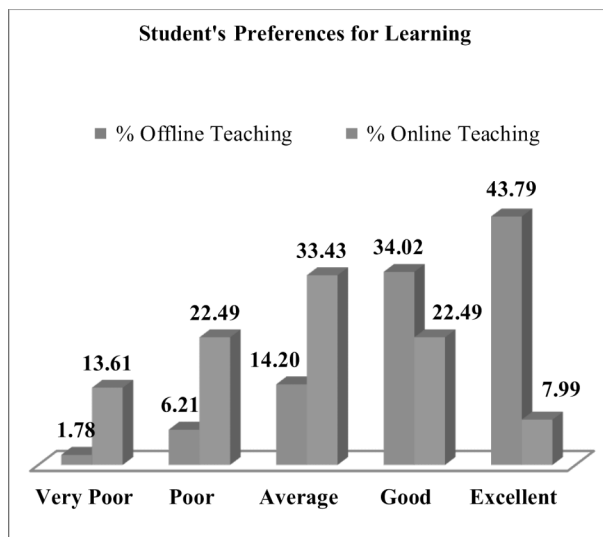

Fig. 2 : Students' preferences for online and offline teaching

In online teaching reading material, books, links are generally shared with students same as in traditional teaching along with live classes. According to this study 83% students use video recordings along with reading material, since video recordings help students to learn the concepts at their own pace.

Another advantage of video recording is flexibility; students can access them anytime. Furthermore, (Means et al., 2010) explain "one class of online learning models uses asynchronous communication tools (e.g., e-mail, threaded discussion boards, newsgroups) to allow users to contribute at their own convenience. Synchronous
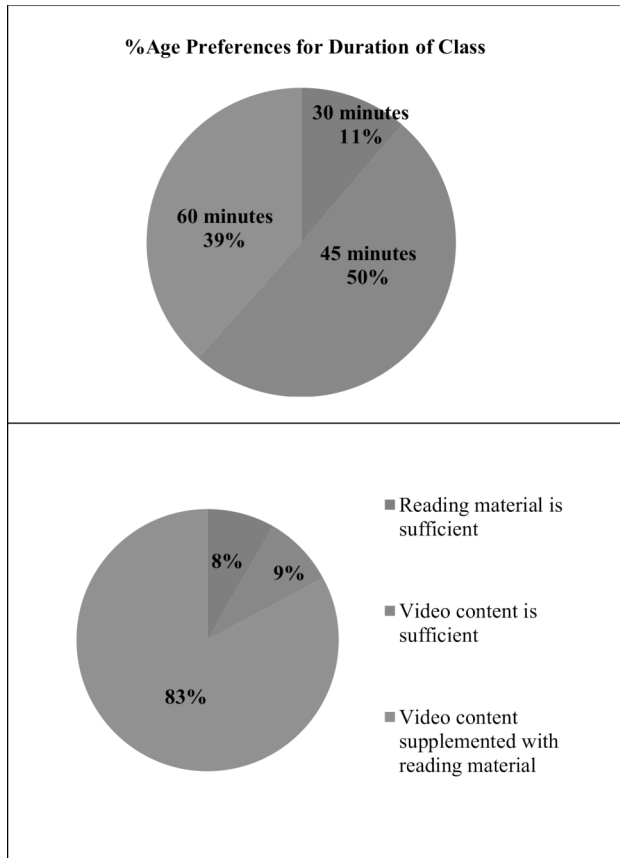
%Age Preferences for Duration of Class

Fig. 3 : Student's preferences for structure of online classes

Fig. 4 : Students' preferences for clarifying queries

online study of this course together with other courses, the same is displayed in Fig. 5(a).

Fig. 5(a) : Students' feedback regarding comfort level

technologies (e.g., webcasting, chat rooms, and desktop audio/video technology) are used to approximate face-to-face teaching strategies such as delivering lectures and holding meetings with groups of students". Student's feedback is must for effective conduction of online classes. With regards to class duration, 39% of students prefer class of 60 minutes whereas 50% are in favor of class of 45 minutes as depicted in Fig. 3.

There were various methods provided to students to clarify their doubts such as live chat, email to concerned instructor and WhatsApp communication. According to this study Fig. 4 reveals, 47% prefer to clear their doubts through live chat as well as email to instructor whereas about 30% preferred WhatsApp for the same.

The conventional teaching meets set schedules and students comfortably study 5 or 6 subjects a day. Under the study it is observed that, on a five -point scale ,78% students feel comfortable in offline learning of this course along with other courses whereas only 42% students have expressed interest in
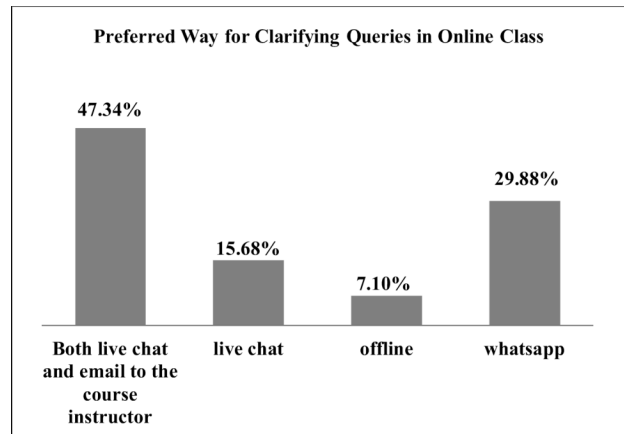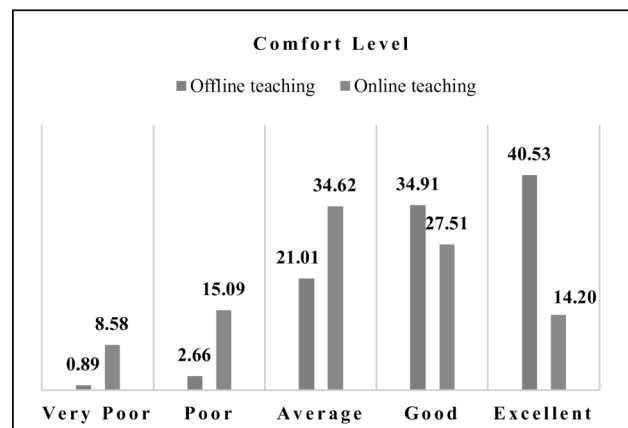
Some researchers say the conventional teaching and learning is still the most efficient method of teaching and learning. (Jabeen & Thomas, 2015) state "the students find learning with an instructor to be a lot more effective than learning alone in an online environment. They prefer classroom environment more than the online setting for language learning". Student teacher interaction happens more easily in conventional teaching as compared to online teaching because of many constraints such as internet connectivity, lack of technical skills etc.

The same is observed from the Fig. 5(b) for online and offline interaction respectively on a five-point continuum scale, where 37% of students have showed their satisfaction for online interaction with the instructor/teacher and peers whereas 55% students reported that offline mode is simple and easily
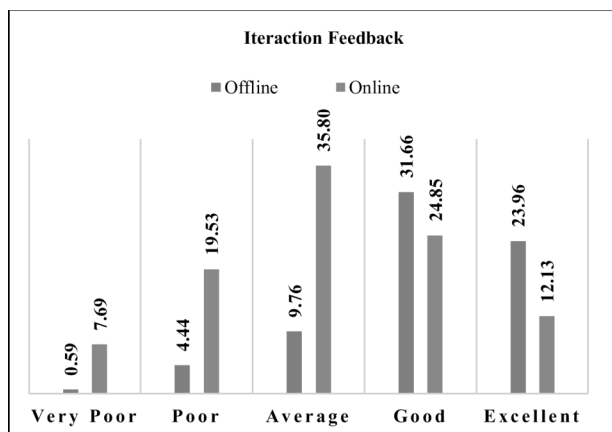
Fig. 5(b) : Students' feedback regarding interaction

available approach for interaction with teachers and peers. Since interaction has been shown to be a key factor in the success of online and blended learning, hence it is crucial to understand how teachers and students perceive the interaction within online and blended courses. The study conducted by (Blaine, 2019) shows that there is scope of improvement in enhancing the communication process between students and teachers in online and blended coursework. Content of courses is considered the secret to the success of online/offline teaching. The contents of the course should be objective-oriented, succinct, and relevant. Subsequently, effective delivery of the contents is also critical for achieving the objective of course. According to the study, it is quite evident that offline class is the preferred method for content delivery with 84% respondents. Its counterpart is reported by 43% respondents. Instructor's competency plays an eminent role for success of online classes. In conventional method, Instructors deliver lectures using blackboard and PPTs. Although whiteboard/PPTs are used for the same in online teaching, However, adapting to new technologies (collaboration platforms) is the key point for its effective execution. Instructor has a choice of course delivery in various institutions those offer courses in various disciplines in both modes online (MOOC) as well as offline (classroom). However, this pandemic has forced the majority of instructors to teach online exclusively. Therefore, he needs to understand about the various online teaching tools/resources that can be integrated in online teaching. Various other factors like teaching attitude, strategies for engagement of students, enthusiasm of instructor, ability to deal with minor issues before and after the class have influence on Instructor's

competency. All these considerations present a great challenge to the instructor, to be effective in online mode of teaching.

**Fig. 6. : Students' preferences for
instructor's competency and content delivery**

Preferences against instructor's competency in offline and online mode are recorded as 76% and 53% respectively as displayed in Fig. 6. This is may be due to unexpected shutdown of institute without rigorous online teaching training. Though online teaching training was there but it definitely takes time to be familiar with it properly. Online instructors play a significant role for success or failure of academic learning and they must be well educated and technically strong, with the intent of introducing and incorporating technological resources, to excel the online learning. This fact was also addressed by (Sun & Chen, 2016) , "teachers definitely and indisputably play a crucial role in online education. They facilitate individual and group discussions, respond to student questions, design course assignments, and evaluate students' learning". Attendance record of students in

online and offline classes are 88% and 84% respectively, which shows student's inclination towards online classes. As exploration of technical skills is the need of hour to excel in every field during Covid-19. Therefore, students are putting their maximum efforts in E-learning. Like attendance, assessment is another major parameter to access the achievement of learner which allows a teacher to know whether students have achieved their educational goals. This may help to redefine the teaching methodology. From this study it can be concluded that majority (75%) of students have shown their interest for appearing in multiple choice questions (MCQs) based exam, whereas 24% students prefer to appear in exam based on subjective as well as objective type questions as shown in Fig. 7(a). Further, online and offline evaluation are preferred by 51%, and 19% of the participants respectively, as preferred mode of evaluation as displayed in Fig. 7(b). Therefore, in addition to redefining teaching method, more attention should be given to the designing of online exams to ensure the fairer evaluation.
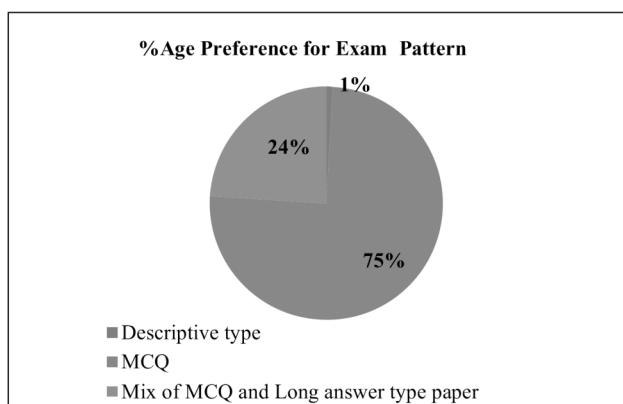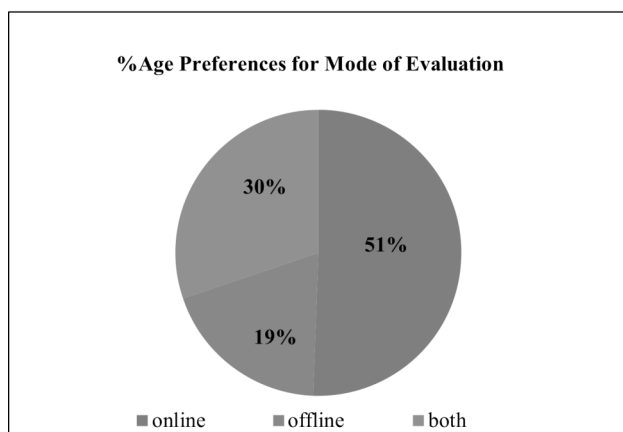

Fig. 7(a) : Students' preferences for exam pattern

Fig. 7(b) : Students' preferences for mode of evaluation

The same is stated by (Butcher & Wilson-Strydom, 2013) that "online environments offer for flexibility in assessment, but if not managed well, this flexibility can create problems of security and authentication". All placement and competitive exams are based on MCQs pattern and conducted online. Additionally, Computer Science Engineering students need to understand the mathematical concepts and inculcate logic building capabilities for developing or using the software packages. Moreover, Mathematics subject doesn't require language skills so it can be evaluated using MCQs. All of these reasons may have contributed to students opting online MCQs exam pattern for assessment of the course.

5. Conclusion :

E-teaching learning is going on and will likely to be germinated. Comparison between online and offline teaching learning is certainly substantial interest to instructors and the focus of several studies. Due to outbreak of Covid-19 all universities/colleges are trying to cope up with the growing demand of online courses. Also, instructor is struggling continuously to meet the intermixed demands of teaching-learning, technology, and a variety of students. Though the change in teaching techniques/methods is quite challenging still it motivates students for learning. In this study we tried to analyze the perception of students for online learning of this particular course. Numerous earlier studies reported mixed outcomes. The present study disclosed that students preferred offline learning for this course even though attendance record proved the great interest of students in online learning that may be due to Covid-19, which improves their technical skills and ability to concentrate, the compulsive need of the current time. Most of them preferred live chat and email to teacher to clear their queries. Preferences against 'interaction with students', more than 50% students preferred offline mode as it is ideal for interaction with the teachers as well as peers. Majority of students felt at ease in offline mode while learning the course along with other courses. According to the study instructor's competency is observed less in online mode as compared to offline mode which may be due to lack of technical expertise. Unfamiliarity with the various online teaching aids/resources like graphic tablet, preparing PPTs with mathematical equations, citing live examples related to Mathematics (which are easy to explain on white board) affect instructor's effectiveness to some extent. So, we can conclude that special online teaching

training could be the solution to reduce the resistance of faculty participation during online activities. In case of assessment, online and MCQs type evaluation is preferred by most of understudies. Since MCQ type pattern is the need of hour, students have to face most of the competitive examinations which are generally based on MCQs and conducted online. Further, exam setter ought to be progressively mindful and creative while conducting online evaluation in order to maintain trustworthy evaluation. Different methodology in teaching learning process increases the interest of students as well as teachers and is a key tool for blended learning. Therefore, utilizing technology in teaching alongside great aspects of conventional teaching learning with MCQ type pattern of examination would have a positive impact on understudy's accomplishment. This study can help the universities/colleges to settle on better choices with respect to course design and can show the worth and capability of online courses.

Acknowledgment:

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