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Original Article

Education Section

Effectiveness of Self-paced and Instructor-led Online Learning: A Study among Phase I Medical Students

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ABSTRACT

Introduction: Online teaching is a crucial challenge in the current pandemic situation. Choosing the right modality for teaching and delivering the information in a very effective manner is critical. Self-paced learning is an important modality that moulds the students into adult learners.

Aim: To compare the effectiveness of teaching modalities like self-paced learning and instructor-led live online lecture class based on performance in assessments.

Materials and Methods: A cross-sectional study was conducted on phase I medical students over a period of three months where they were given self-paced learning and online instructor-led lecture sessions. Topics and reading materials for self-paced learning were provided to the participants through Telegram. After one week they were evaluated using objective-based assessments. Instructor-led live online lecture classes also were taken for them through Impartus followed by assessments. Independent t-test was done to assess the difference between the both performances based on the scores attained.

Results: Total of 86 subjects were included in which 54 were females with mean age 18.75 years and 32 males with mean age 18.84 years. After online lecture sessions, 93.02% (n=80) of students came in the high performers group, while only 65.12% (n=56) of students belonged in self-paced learning sessions. There was no significant difference in performance in both modalities between gender (p>0.05).

Conclusion: Instructor-led live online methods are more effective than self-paced learning. Self-paced learning is also important in education as it enhances the quality of adult learning. Implementing e-learning into the current syllabus can be more productive as it augments student teacher interaction.

Keywords: Medical education, Online teaching modality, Self-directed learning

INTRODUCTION

Training of medical students in the current scenario of the Coronavirus Disease-2019 (COVID-19) pandemic is challenging. The compulsion to train without compromise on quality has resulted in the educators exploring different modalities of e-learning. Sudden shift from the traditional teaching modalities to e-learning platforms has been challenging not just for the educator but also for the students. Learning approaches vary for each student and educators are faced with the task of finding a suitable modality which is beneficial for all types of learners. The present medical curriculum of Competency Based Medical Education (CBME) focuses on attaining competencies and skills for critical analysis of new information, linking the new information to what they already know and utilising this information for problem solving [1]. Educating a medical student hence involves a multifaceted approach which could be done with ease in the traditional teaching system. In e-learning, all focus is on the content delivered. Segregating the learning content into “must know” and “nice to know” seems to be the prime responsibility of the educators. But the question of how these contents are delivered seems to be evaded by most educators. Some studies have explored into the merits and demerits of online education and the importance of forming an effective method of content delivery [2,3].

The present scenario of the pandemic has led to the rise of various educational platforms where the content is being delivered using multiple modalities [4,5]. The manner in which the educational content is delivered can create a massive difference in how knowledge is acquired and retained by the learner. Few researchers have explored in discovering the most fruitful method of conveying the information. White LJ et al., have compared face to face lectures and online delivery of content through videos and learning modules and found no difference in students’ performance [6]. Root WB and Rehfeldt RA compared on campus lecture and online lectures based on evaluation of quizzes conducted and supported the potential of online lecture. Their study highlighted the importance of implementing online studies into the curriculum [7]. The students, are used to the presence of a facilitator in their learning process, we as educators being concerned regarding how they would fare, if the learning process was left to them. The present study was planned based on this backdrop.

Medical students being adult learners, self-paced learning or Self-Directed Learning (SDL) seems to be a promising approach as each learner can decide the pace of his or her learning [8]. A self-paced learning is a type of learning, where a particular amount of work is completed at their own pace without any guidance from the faculty [9]. Instructor-led learning is one of the familiar methods of learning in which an instructor or faculty facilitates the teaching session for a group of students. The students are able to have an opportunity to discuss or learn from the faculty during the session itself. Various elements can be incorporated of learning like discussion, hands on training, group activities during the session [10]. Hence, the aim of this study was to compare the effectiveness of self-paced learning and instructor-led live online lectures based on the performance of students in assessments.

MATERIALS AND METHODS

This cross-sectional study was conducted among Phase I MBBS students of Jubilee Mission Medical College and Research Institute, in Thrissur, Kerala, India, in the year 2020 for a duration of three months, (April-June, 2020). Convenient sampling method was used and all 100 medical students of Phase I who were willing and gave consent to participate in the study were recruited. This study was approved by the Institutional Ethics Committee (IEC) (27/20/IEC/JMMC&RI). Students were provided with self-paced learning sessions and online lecture sessions for which they were evaluated. Performance of the students in both sessions were analysed.

Inclusion criteria: Phase I MBBS students who were willing to participate in the study.

Exclusion criteria: Students who were not willing to participate or who did not have access to the network connection for participating in online sessions were excluded.

Self-paced Learning

A Telegram group was formed including all 100 students and the faculty. The self-paced learning was conducted in four sessions. For every session, students were given case-based scenarios regarding particular topic and the literature study materials based on the topic, links for reference from other sources were shared in the group. The topics for four self-paced learning sessions were, regulation of body temperature, taste pathway and modalities, blood brain barrier and cerebrospinal fluid. A gap of one week duration was given between each topic. Three days were provided for preparing each topic. Following this, after each session, they were evaluated by giving an objective type assessment (10 multiple choice questions) through google forms. Students were free to clarify their doubts regarding the case and the topic to the respective faculty directly through telegram or whatsapp. The students were notified regarding the assessment well in advance prior to the announcement of topics. After the evaluation, the list of toppers was displayed in the telegram group and they were appreciated by the faculty. This was how they were motivated.

Instructor-led Live Online Lecture Sessions

Live lecture sessions were conducted online through Impartus (an online learning management software). Interaction and active participation of the students were assured throughout the session where faculties used to ask questions to the students, students were free to ask doubts through available services on the platform. Thus, this provided a platform for open discussions and live interaction. Each lecture session lasted till the end of case discussion and the explanation of the topic regarding the case. Approximately the sessions lasted for 1.5 to 2 hours. The live lecture sessions were conducted online, where faculty could observe each student through webcam. At the beginning, the faculty provided a clinical case scenario to the students through a presentation. The students' participation was monitored throughout the lecture. Cases like spinal cord injuries, Parkinsonism, referred pain, abnormalities in vision were given for lecture sessions.

For example, a 72-year-old man came to the medicine Out Patient Department (OPD), complaining of weakness. On examination, the doctor observed pill rolling tremors, mask like face and cogwheel rigidity. He was walking with mild forward bend posture and short steps". The students were asked to comment and give justification regarding the diagnosis. This was followed by giving detailed lectures on the topics and the physiology of the systems involved in particular to the case scenario. Students who participated well in class activity were appreciated and bonus points were awarded.

Evaluation: Online lecture and self-paced learning sessions were evaluated by objective type assessments, which was conducted online using google forms. The questions were of cased scenario based type to evoke their higher order thinking. Difficulty indexes of the questions were taken into account. The faculty in the department framed the questions. A total of 15 questions were framed from each topic and each question carried one mark.

The order of the questions was changed using the shuffling option in the platform. The questions were given at 10 am in the morning and they had to submit the answers by evening 10 pm. The students were divided into four groups as high performers (>75%), medium performers (>65-75%), average performers (50-65%) and very low performers (<50%) based on their scores in assessments following self-paced learning and online lecture sessions.

STATISTICAL ANALYSIS

The performance of the assessments was tabulated in a spreadsheet. The normality of the data was checked using Q-Q plot and it was normally distributed. The difference between the performances of students after going through the above teaching modalities was done using Paired t-test. Independent t-test was performed to explore the difference in performances between male and female students. Pearson's correlation was performed to find the correlation between self-paced learning and online lecture sessions of students. The p-value of <0.05 was taken as significant. The data was analysed using Statistical Package for the Social Sciences (SPSS) software version 20.0.

RESULTS

All phase I MBBS students participated in this study and the data of 14 students were excluded for the study as they missed few assessments. For analysis, the final sample included 54 females (mean age=18.75 years) and 32 males (mean age=18.84 years). After online lecture sessions, 93.02% (n=80) of students came in the high performers group, while only 65.12% (n=56) of students belonged in self-paced learning sessions [Table/Fig-1]. The percentage of very low performer students was almost equal after both sessions.

Percentage of marks	>75%	>65-75%	50-65%	<50%
Self-paced learning	56 (65.12)	20 (23.26)	9 (10.47)	1 (1.15)
Online lecture	80 (93.02)	4 (4.65)	1 (1.15)	1 (1.15)

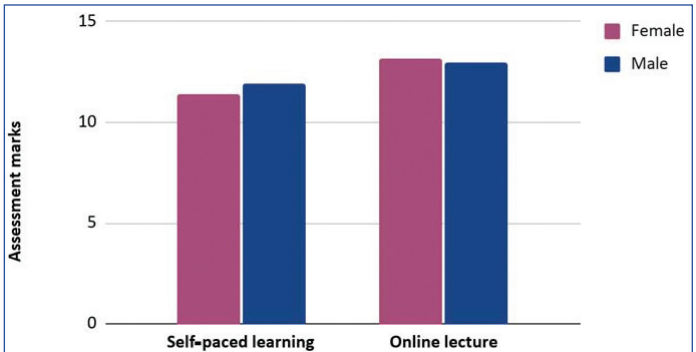
[Table/Fig-1]: Distribution of students in groups based on marks (n=86). Percentage of students in parentheses

The score attained by the students is exhibited in [Table/Fig-2] and it shows that the score attained after the online lecture session was significantly higher than after the self-paced learning session (p<0.001). This pattern was similar even when compared in males and females separately.

Teaching modality	Self-paced learning	Online lecture	p-value*
Performance (overall)	11.58±1.46	13.08±1.32	<0.001
Female (n=54)	11.38±1.47	13.13±1.05	<0.001
Male (n=32)	11.93±1.37	12.99±1.69	<0.001

[Table/Fig-2]: Performance of students following various teaching modalities. Data represented as Mean±SD. Paired t-test, *level of significance p<0.001 (highly significant)

The scores obtained have been compared between female and male students are shown in [Table/Fig-3]. It shows no significant difference in both self-paced learning and online lecture sessions (p=0.08 and 0.12, respectively).



[Table/Fig-3]: Comparison between female and male students. Data represented as Mean±SD. Independent t-test

The correlation between self-paced learning and online lecture sessions of the students have been illustrated in [Table/Fig-4]. [Table/Fig-5] depicts the correlation between two learning methods within gender and shows that male students have a stronger correlation (Pearson's correlation) (r=0.82) than females (r=0.62).

[Table/Fig-4]: Performance trend of students (n=86).
Pearson's correlation. Correlation coefficient (r)=0.66 p-value=0.001

Learning modality	Instructor-led learning			
	Male (n=32)		Female (n=54)	
	Correlation coefficient	p-value	Correlation coefficient	p-value
Self-paced learning	0.82	0.0002*	0.62	0.0001*

[Table/Fig-5]: Correlation between online self-paced learning and lecture among gender.
Pearson's correlation, *significance level p<0.01

DISCUSSION

Online training in medical education is the least explored area. The current scenario of the COVID-19 pandemic has opened up areas to examine and explore this method of teaching and learning. The present medical curriculum, CBME, focuses on the attainment of competencies by a medical graduate [1]. Online education is challenging to both the students and the faculty in terms of how to deliver the knowledge in an effective way. An effective teaching methodology should be in such a way that the students should be able to process the information and apply that knowledge. Hence, the focus should not be on the content delivery alone but also in the process of how the content is being delivered [11].

The prime focus of the present study was to determine which process of e-learning is beneficial to the students. In this study, self-paced e-learning and instructor-led online lecture was compared based on the performances in the assessments. The primary outcome of the study was that the performances of the students were significantly higher for instructor-led modality than for the self-paced learning method and a greater percentage of students belonged to the high performers group after the instructor-led modality.

A previous study done by Pai KM et al., has found that Self-Directed Learning (SDL) was as effective as a lecture session in acquiring information as there was no significant difference between the mean scores of a group that underwent SDL and the other group that underwent lecture with SDL [12]. In this study, the mean score after the online lecture session was significantly higher than after the online self-paced learning session, which shows that the students were able to grasp the information better after the lecture session. When we looked into the difference between the performance in the sessions among females and males students separately, the result was similar and hence, it can be concluded that it has no association with gender.

In the present study, it was found that most of the students (93.02%) belonged to the high performers group after the online instructor-led session whereas only 63.12% of students categorised into this group after the online self-paced learning session. This was contradicting the results shown by Pai KM et al., where there was no difference between the groups in categories like high medium or low [12]. There were an equal proportion of students, when looked into the low performer group. In few other studies, the self-instructed group of students outperformed the students in the lecture group comparing the pre and post-test outcomes [13,14].

When compared between females and male students, there was no significant difference in performance in online self-paced learning and online instructor-led sessions separately this finding was in par with another study done by Premkumar K et al., [15]. This states that students in both sexes have equal capacity in comprehending the information even if self-paced. Gyawali S et al., also expressed that there is no significant difference between gender on acceptance of SDL [16].

The correlation between the two sessions based on the performance of all the students was shown and it exhibited that there was no strong correlation (r=0.66). There was a big cluster in the graph which says that some of the students performed better after both sessions. A group of students performed better after the online instructor-led session but not in the self-paced learning session. This reveals that the dependence on self-paced learning completely for delivering information cannot be advisable. This also depends on the topics involved because some of them require application of knowledge for clinical and practical purposes. Certain topics needed an additional effort and guidance from facilitators as well. Raupach T et al., have found in their study that for delivering information regarding an applied technical procedure like Electrocardiogram (ECG), a clinical skill, near-peer learning is effective [17]. This means that the presence of a facilitator is necessary for understanding certain topics, skills, procedures etc. to increase the efficacy in knowledge delivery. In present study, the difficulty index of the topics involved in self-paced learning and instructor-led sessions were the same. However, the ability and capacity in registering the information might be different for the students.

Self-Directed Learning (SDL) serves as a method, where the medical students, who are lifelong learners, gain the ability as self-learners and it has to be implemented in the education system. It is important that they should be updated with the immense development of scientific knowledge [18,19]. The real question is, whether the students are ready for this quick transition from teacher centered learning methods followed in schools to an adult learning set up in colleges. We can mould them and develop their self-learning ability by giving short topics in the first year of medicine rather than assigning a greater number of topics to them through self-paced learning. Hence, it is better to incorporate both types of modalities like instructor-led sessions and self-paced learning in education. The efficacy of SDL is questionable and doubtful which is exhibited from the performance during the assessments. This could be due to the lack of motivation in students during the course of study as they are locked up in their houses due this current situation. The methods to develop motivation in students can be one of the areas to focus on. Summary of different studies that have compared SDL and lecture methods are given in [Table/Fig-6] [12-14,20].

Sl. No.	Author's name and publication year	Place of study	Number of subjects	Techniques compared	Conclusion
1.	Peine A et al., [20] 2016	Aachen, Germany	55 in each group	Lecture, self-instructed learning, e-learning	Self-instructed group outperformed teacher instructed group
2.	Vinay G and Veerapu N, [13] 2019	Telengana, India	80 (compared among themselves)	Self-directed learning and didactic lecture	Learning outcomes were better after self-directed learning
3.	Mahmoud FN [14] 2015	Cairo, Egypt	60 in each group	Self-learning package and lecture	Self-learning package can be made complementary
4.	Pai KM et al., [12] 2014	Manipal, India	125 in each group	Self-directed learning and lecture	Self-directed learning was equally effective as lecture
5.	Present study 2022	Kerala, India	100 (compared among themselves)	Online self-paced learning and online instructor-led learning	Online instructor-led learning was more effective than self-paced learning

[Table/Fig-6]: Summary of different studies that compared Self-Directed Learning (SDL) and lecture methods [12-14,20].

In contrast to present findings, a study done by Peine A et al., found that students who belonged to self-instructed (non guided)

group and e-learning group performed better than teacher centered groups [20]. This could be because in this study, the investigators gave a single topic for a duration of four weeks whereas in present study, several topics were covered in a short time which could have affected the students who were slow learners. Learning a topic by self-paced learning requires more time when compared to a teacher centered learning [21,22]. In India, the duration of medical course is 4.5 years and in Phase I the duration is hardly a year where the entire topics of basic subjects like anatomy, physiology and biochemistry is covered. The students will find it difficult to acquire a vast knowledge in a short period of time. Implementing online self-paced learning only in the current scenario would be not feasible.

A study done by Rafi AM et al., on conventional methods of teaching in medical students based on feedback from them, found that students prefer an online learning platform as a student friendly platform, where the teacher could interact with the students and students were able to participate actively throughout the lecture [5]. Therefore, even after the present pandemic situation reverses back to the earlier set up, blended learning or incorporating e-learning into the education system is important. Usage of student friendly e-learning methods can increase student and teacher interaction compared with big classroom lectures. It will be an opportunity for the students who are not open enough to interact with teachers in front of the crowd.

Limitation(s)

The students' ability in grasping the knowledge is variable. Some students are motivated whereas others are least encouraged in self-paced learning especially in the current situation, being at their comfortable zone as in home environment may not be feasible for few students to get into a learning atmosphere. In this study, all the students could not be included as some of them missed some sessions and the topics assessed were also limited.

CONCLUSION(S)

Instructor-led method of learning is more fruitful than self-paced learning which was based on the scores attained in the assessments. There was no difference in the scores attained when males and females were compared. Learning difficult topics that require guidance have to be considered and to augment student teacher interaction implementing blended learning could be a better choice. The method of self-paced learning can be started from school level itself, thus can help develop the students' capability to get self-motivated and self-learn. Building up motivation in students in this current lockdown situation has to be focused on. Further studies have to be done to find out an effective method of delivering the online lecture using the latest technologies in a multicentric set-up that augment their motivation in learning.

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