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Google Classroom platform for Physiology teaching in Medical College

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Abstract: *Objective:* Was to use Google Classroom as a Learning Management System for teaching and learning a topic in Physiology and to assess performance and perceptions first year MBBS students. *Methods:* The content shared in the Google Classroom. A feedback form having 14 questions in a Likert Scale format and open ended feedback question, prepared using Google Forms. 176 students completed MCQ assignment. 40 students completed the feedback. The total score of MCQs were calculated. Other parameters of MCQs like difficulty index, discrimination index, etc were obtained and analysed using Microsoft Excel 2016. *Results:* Of 176 students who submitted MCQ, the total score obtained was 10.5±2.36, Difficulty index was 51.80±11.80%, Discrimination index 0.24 ± 0.06, Distractor efficiency was 63± 28%. Feedback analysis revealed, the lecture delivery, accessibility, applicability, problem solving ability and technical issues. The questions regarding lectures like the format of lecture, understanding the concept, liking and enjoying the lecture and retention of knowledge were positively responded by the students. The accessibility and availability in various places and devices was most of the students agreed to. The applicability of knowledge in clinical situation particularly various mental disorders was explored and more than 50% students agreed that it will help in clinical application and understanding of pathophysiology of various diseases. Less than 50% students thought that it will help in problems solving. *Conclusion:* Google classroom is a great platform for teaching Physiology as it improves and ensures learning in virtual settings.

Keywords: Google classroom, eLearning, Medical Education, Physiology.

Introduction

E- learning is expanding in various fields of education. Medical education is no exception to it. eLearning is learning utilizing electronic technologies to access educational curriculum outside of a traditional classroom. In most cases, it refers to a course, program or degree delivered completely online. There are many terms used to describe learning that is delivered online, via the internet, ranging from Distance Education, to computerized electronic learning, online learning, internet learning and many others.

E- learning provides the learner control over content, the pace of learning, the progression of learning, and in providing various types of media to access, e-learning platforms have developed in leaps and bounds. E-learning has metamorphise adaptive learning, collaborative learning, and the way in which a teacher facilitates teaching-learning and assessment. Medical education has grown in e-learning arena with various technology.

Learning management systems (LMS) or virtual classrooms are used as an integral part of e-learning activities in medical education. A LMS apart than functioning as a repository of e-learning resources simplifies and automates the administrative functions. Although a LMS does the supervisory work, it also tracks students' performance and handling e-learning for an entire institution. Many studies, both quantitative and qualitative, have shown that individualized or adaptive learning and interactive or collaborative learning, both facilitated by e-learning technologies have resulted in greater learner satisfaction, knowledge improvement, and understanding of concepts among other positive outcomes [1-2].

However, learning process is optimum when there is both personalized and assisted, and in that scope, after the widespread availability of Web 3.0 tools, blended learning has come to become a mainstay in higher education. Most outcome comparison studies have established that blended curriculum has either shown better or similar improvement in comparison to traditional curriculum [3-4]. Use of e-learning in resource-limited low and middle income countries like India has the potential to make it more democratic, accessible, and effective.

In a study, conducted in a medical school in Berlin in 2016, it was shown that 74% students viewed Wikipedia as their primary source for acquiring knowledge. This high approval of free online resources comes as a worry to teachers who can certify the need for accuracy, legitimacy, and right quantity of content. And with a plethora of such information available, the need for a LMS to facilitate delivery of vetted content by the facilitator is required [5].

Secondly, the students are not able to attend classes because situation like COVID 19 pandemic or any such situation and the syllabus has to be completed. In such cases, LMS is boon. There are many free online teaching platforms which can be used as LMS like Moodle, Namaste app, Zoom, google classroom, skype, ezTALkS, fastmeeting, Udemy, Moodle, Youtube, etc. which should be explored and leverage upon for teaching-learning. Some are live and some prerecorded content which can be delivered through these platforms.

Some allow questioning, chat and discussion. Some allow to post various assignments and grading. The number of students and duration of class in each may be variable. A recent addition in May 2014 to the already available and ever growing learning management systems has been Google Classroom, a component of Google Apps for Education, a free suite of productivity tools including Gmail, Drive, Docs, etc. Ease of use, time saving, free, flexibility, mobile friendliness, and cloud-based nature have been described as benefits of Google Classroom [6].

The objective of this study was to use Google Classroom as a Learning Management System for teaching and learning a topic in Physiology and to assess performance and perceptions first year MBBS students.

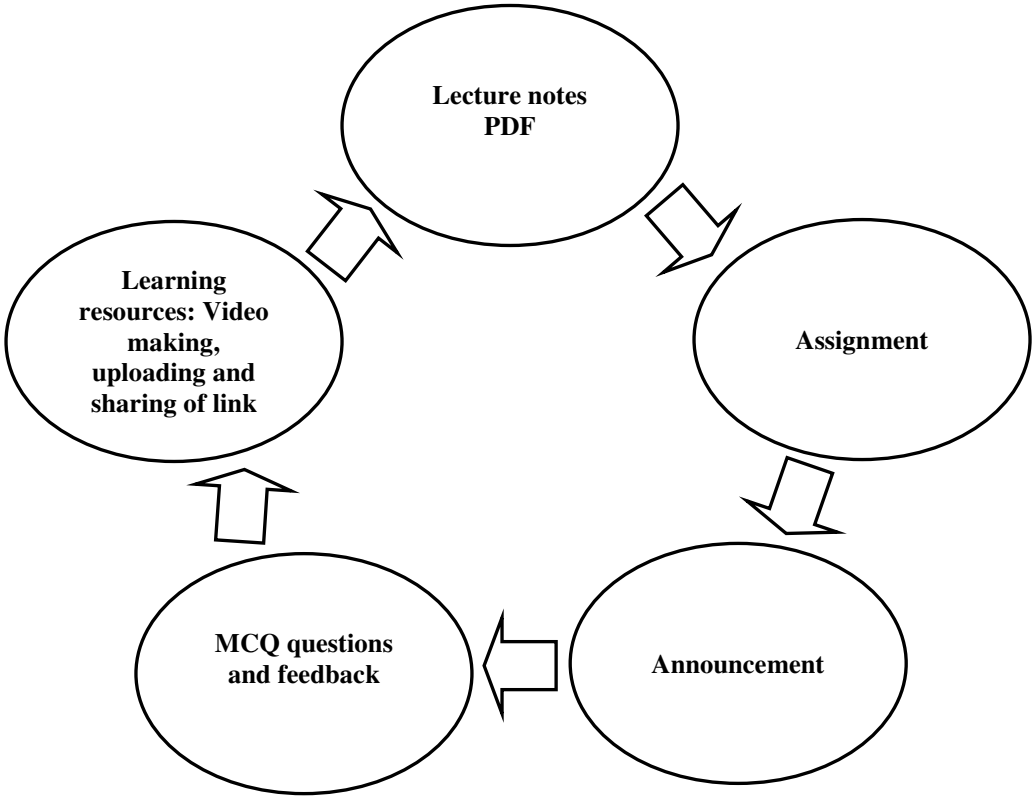
Material and Methods

Setting: Lokmanya Tilak Municipal Medical College (LTMMC) under Municipal Cooperation of Greater Mumbai (MCGM) is a premier school of medicine in India's leading university, Maharashtra University of Health Sciences (MUHS). The student intake for M.B.B.S. course 200. The M.B.B.S. course is of four and half year plus one-year internship and the curriculum is aligned with Competency Based Undergraduate Curriculum by MCI [7].

The first year curriculum, taught in a system-based manner, includes Anatomy, Physiology, and Biochemistry along with Community medicine and Foundation course modules. Physiology is taught in the first year of the program using mainly lectures, followed by self-directed learning (SDL) modules, Early Clinical Exposure (ECE) and AETCOM modules. Topics are randomly divided and assigned to faculty members. The academic year has been divided 3 terms. The MBBS program at LTMMC does not use any structured e-learning tools for teaching.

Design: Google classroom was set up by the author before the commencement of classes. The content shared in the Google Classroom can be broadly classified into five types: (i) Video lecture prepared using MS Powerpoint, recorded and edited in DU recorder, uploaded on YouTube. Can be accessed on following link: https://youtu.be/L3zITJRZwT0 (ii) lecture notes, which included the pdf of ppt which was uploaded in Google classroom; (iii) quiz, comprising of MCQs; (iv) announcements about forthcoming activities in the classroom; and (v) assignments requiring submission in the Google Classroom platform (Fig. 1).

Fig-1: Workflow of Google Classroom Teaching



After the end of all the class, a feedback form having 14 questions in a Likert Scale format and open ended feedback question, prepared using Google Forms, was posted in the Google Classroom. The questionnaire was developed based on theories of Learning Delivery and Kirkpatricks evaluation framework, modified for medical education [3, 7]. The Google Classroom code allotted is l6vdmp4. The students were shared classroom code on whatsapp. Ethical clearance was sought and written consent obtained. All 200 students were invited to participated. 176 students completed MCQ assignment. 40 students completed the feedback. The total score of MCQs were calculated and shared with the students. Other parameters of MCQs like difficulty index, discrimination index,etc were obtained and analysed using Microsoft Excel 2016.

Paper comprised of 17 MCQs, each having a single stem with four options including one correct answer and three distractors (incorrect answers). Each MCQ was assigned one mark. Maximum marks possible to score were 16 and minimum was zero, with no negative marking. For item analysis, results of all papers were ranked in descending order, from highest marks to lowest marks. Then papers were divided into groups. Highest 27 % were considered high scored (n=45) groups (H) and lowest 27 % were considered low scored (n=45) groups (L) were included into the analysis. Paper with average scores, (n=86) were excluded from the study. Difficulty index (DIF), Discrimination index (DI) and Distractor efficiency (DE) were calculated to evaluate the MCQs. DIF represents the percentage of students who correctly answer the questions.

A higher value of DIF shows that increased number of students gave the correct answer. It indirectly proves that questions are easy to attempt. The range of DIF is from 0-100%. Following formula is used to calculate the DIF DIF= [(H+L)/N] × 100 H= Number of students gave correct options in high score group L=Number of students gave correct options in low score group T=Total number of students in both groups Criteria of categorization in DIF is: DIF>70%=Too easy,

DIF b/w 50-60%= Good, DIF. DI is categorized as: DI≤0.2= Poor, DI b/w 0.21-0.24= Acceptable, DI b/w 0.25-0.35= Good, DI≥0.36=Excellent. DE is the ability of incorrect answers to distract the students. If < 5% students choose the incorrect answers, it is called non-functioning distractor (NFD).

Distractors selected by >5% of students is called functional distractors (FD). The range of DE is 0-100%. DE is categorized on the basis of the number of NFD present in a MCQ. If MCQ has 3 or more NFDs, its DE is 0%. DE is labeled as 33.3%, 66.6% and 100% on the basis of the presence of 2, 1 or none NFD in an MCQ. 11, 12 Data was entered in Microsoft Excel 2016 and SPSS 21. Quantitative variables were expressed as Mean ± SD. The feedback obtained was also analysed using Microsoft Excel and Cronbach alpha calculated was equal to 0.87 which is an acceptable internal consistency (Cronbach alpha more than 0.7 is considered acceptable). The feedback questionnaire was tested for reliability and validity. The feedback was further analysed and data is presented in result section of the paper. Qualitative variables analysed by coding and decoding to get the inference.

Results

All 200 students participated in the studies. Of which 176 submitted MCQ assignment by deadline and only 40 students submitted the Likert scale feedback. The response rate was 88% for MCQ assignment and 20% for feedback inspite of repeated reminder. Of 176 students who submitted MCQ, the total score obtained was 10.5±2.36, Difficulty index was 51.80±11.80%, Discrimination index 0.24 ± 0.06, Distractor efficiency was 63± 28%

Table-1: Characteristics of MCQs

Parameters	Result
Students (n)	176
MCQs (n)	16
Score Total (n)	16
Score obtained (Mean±SD)	10.50±2.36
Difficulty index (%) Mean±SD	51.80±11.80
Discrimination index Mean±SD	0.24 ±0.06
Distractor efficiency (%) Mean±SD	63±28

Table-2: Analysis of Difficulty Index

Difficulty Index	No. of MCQs
>70%=Too easy	1
b/w 30-70%=Average	14
<30%=Too difficult	1

Fig-2: Analysis of difficulty index, most of the MCQs were average

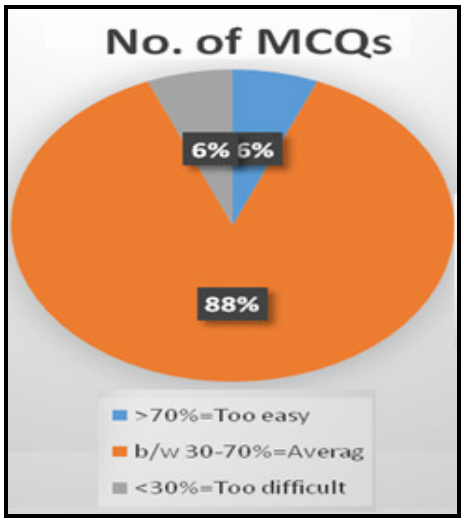


Table-3: Discrimination Analysis

Discrimination Index	No. of MCQs
≤0.2= Poor,	2
b/w 0.21-0.24= Acceptable	10
b/w 0.25-0.35= Good,	2
≥0.36=Excellent	2

Fig-3: Discrimination index, most MCQs were acceptable, good and excellent

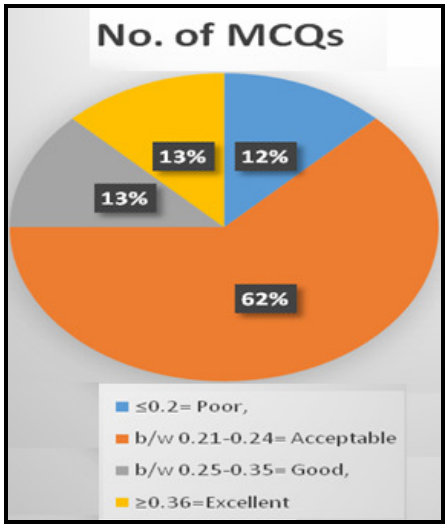
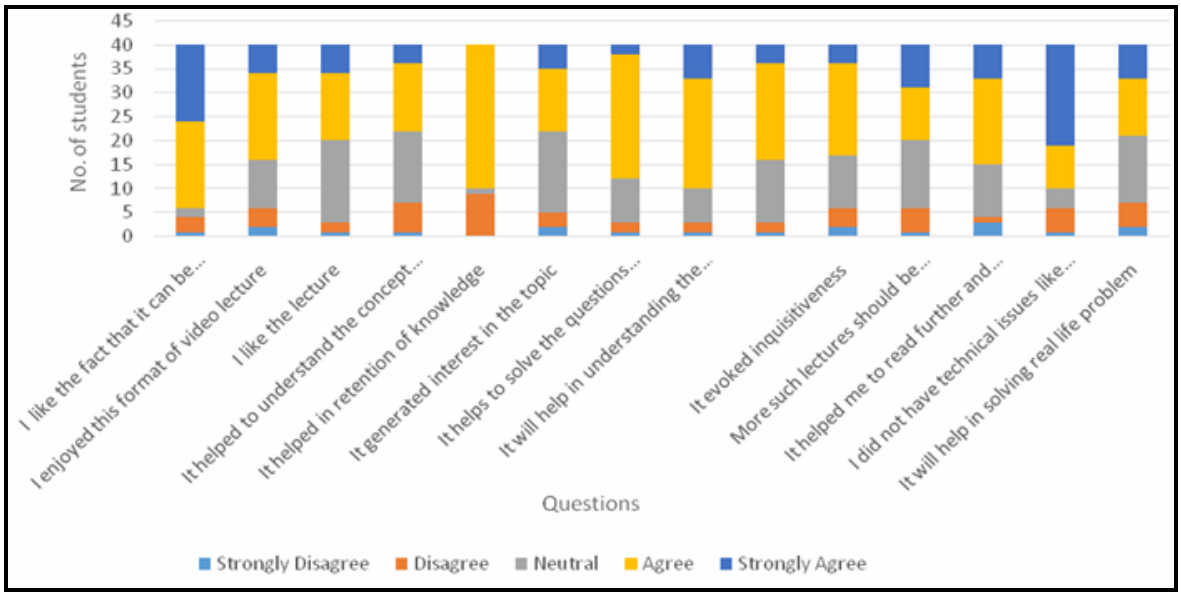


Table-4: Distractor analysis	
Parameters	**Number (%)**
MCQs (Total)	16
Distractors (Total)	48
Functional Distractors	31
Non-Functional Distractors	17
MCQs with zero NFDs/ 4 FDs (DE=100%)	4
MCQs with 1 NFDs / 3 FDs (DE=66.6%)	8
MCQs with 2 NFD s / 2 FDs (DE=33.3%)	3
MCQs with 3 or more NFDs / 1 or 0 FDs (DE=0%)	1

Most of the distractors were functional. Therefore, 12 MCQs had more 66.6% distractor efficiency. Analysis of students' feedback: 40 students returned the questionnaire which was analysed on the basis of how many strongly disagree to strongly agree.

The feedbacks of 40 students who completed it till deadline were considered for analysis. The questions were regarding the lecture delivery, accessibility, applicability, problem solving ability and technical issues. The questions regarding lectures like the format of lecture, understanding the concept, liking and enjoying the lecture and retention of knowledge were positively responded by the students.

Fig-4: Students' Feedback on Google Classroom



The accessibility and availability in various places and devices was most of the students agreed to. The applicability of knowledge in clinical situation particularly various mental disorders was explored and more than 50% students agreed that it will help in clinical application and understanding of pathophysiology of various diseases. Less than 50% students thought that it will help in problems solving. Less than 10% students had some technical issues as reflected by the response to such question. The technical issues faced by students will be analysed in open ended question in feedback. The qualitative analysis of open ended feedback question was analysed and following was the findings:

Any feedback you would like to give regarding the lecture (delivery, design, technical issue, content and applicability) was classified as positive and negative. The negative feedback will be considered as constructive criticism for further improvement.

Table-5: Analysis of open ended feedback question	
Positive feedback	**Negative feedback**
really good initiative	a bit unclear
Helpful	Live lectures with attendance, that will be better
This format is very practical & convenient	video is too long. Can be done in short sections
presented in a lucid manner	

As reflected from open ended feedback analysis, the students have commented mostly about lecture and lecture delivery which will definitely help in improving the lecture. But the technical difficulties, if any, is not mentioned by any student.

Discussion

The study was undertaken to explore the utility of Google classroom for conducting lecture and assignment on Limbic system in Physiology for first M.B.B.S. students. The objective of study was to assess performance and perception of students. The Google classroom session consist of a video lecture and notes in PDF format. For assessment, MCQs were posted in Google form in the assignment section. For feedback, 5 point Likert scale along with open ended question was posted in Google form format in assignment section. Out of 200 students, only 176 submitted MCQs and 40 completed feedbacks. Therefore, response rate turns out to be 88% and 20% for MCQs and feedback respectively. MCQ response rate was good but feedback response rate was not satisfactory.

MCQ with single best response is an effective way to assess the student's cognitive knowledge. According to Blooms taxonomy, a well-constructed MCQ is an effective tool to quickly evaluate different levels of cognition like comprehension, application, analysis, and synthesis among students [8-9]. For an ideal MCQ level of difficulty should be average with (30-70%) with high DI (>0.25) and 100% DE [10-11]. In our study, according to DIF criteria, out of 16 MCQs, 14 fulfils the criteria of an ideal MCQ. As per the DI and DE, total 14 and 4 fall in the categorization of ideal MCQ. There were total 4(25%) MCQs which satisfied all the three criteria of ideal MCQs. Our results are comparable to a study conducted at Pondicherry Medical College. In that study, out of 30 MCQs 15(50%) fulfilled the criteria of DIF for ideal MCQs, while 21(70%) and 17(57%) MCQs satisfied the criteria of DI and DE for an ideal MCQ. There were 3(10%) MCQs, which overall fulfilled the standards of ideal MCQs [8].

In our study, mean and standard deviation for DIF, DI and DE were fallen in the category of good MCQs [9]. These results are almost similar to a study analyzed 30 MCQs showing mean DIF and DE in the range of good MCQs. Their DI fall in the category of excellent MCQ [12]. Another study done item analysis of 40 MCQs, revealed mean DIF and DI almost in accordance to our study (average MCQs) with high mean DE (excellent MCQs) [10].

In a study conducted at Ghana, analysis of 50 test items revealed that mean DIF and DE was average and DI was an acceptable group [13]. Regarding difficulty index, in our study out of total 16 MCQs, 1(6%) MCQ was too difficult and 1(6%) were too easy. Total 14(88%) MCQs were in acceptable and good category. Results are comparable to another study analyzing 40 MCQs. Study revealed that 7(17.5%) MCQs were too easy and 3(7%) were too difficult. Remaining 18(45%) and 12(30%) were fall in acceptable and ideal category respectively [14]. Another study conducted in 2016 showed that out of total 30 MCQs, 5(17%) were very easy and 11(37%) were too difficult. Remaining 4(13%) and 10(33%) fall in the category of good and very good respectively [10].

A study conducted at Medical College Ahmedabad in 2017 accessed 5 papers comprising of total 200 MCQs. The study revealed that 74(37%) MCQs were too difficult and 33(16%) were too easy. Remaining 93(46%) MCQs were in the average category [15]. Another study analyzing MCQ paper consisting of 30 questions showed that 2(7%), 24(80%) and 4(13%) MCQs were too easy, acceptable and too difficult respectively [16].

In the present study, concerning discrimination tendency, 13% MCQs showed excellent predisposition to distinguish students gaining low and high marks. While 13%, 62% and 12% MCQs demonstrated good, acceptable and poor discrimination ability respectively. A study conducted in 2017, analyzed discrimination tendency of 40 MCQs. The study demonstrated that 17(42.5%) and 7(17.5%) MCQs had excellent and good discrimination tendency respectively. While 1(2.5%) MCQ fall in acceptable range and 15(37.5%) had poor tendency to discriminate the low and high performers [14].

In a medical college at Pondicherry, analysis of 30 MCQs revealed that 9(30%) had poor discrimination tendency. While 6(20%) and 15(50%) MCQs were categorized as having good and very good tendency to discriminate students on performance basis [15]. A study analyzing discrimination tendency of questions given in 5 tests showed that out of 200 MCQs, 79 (39.5%) had poor while 47(23.5%), 13(6.5%) and 61(30.5%) MCQs had marginal, good and excellent DI respectively [10].

A study conducted at Govt medical college categorized 30 MCQs into 8(27%), 3(10%) and 19(63%) as having poor, good and excellent DI [13]. The present study showed that in 4 (25%) MCQs all four wrong options fully distracted the student's attention. While 4(25%) and 8(50%) MCQs had 3 and 2 functional distractors respectively. Only 1(6.255%) MCQs were with one functional distractor. Results are in accordance with study conducted in 2017 showing 8(26.6%) MCQs with all three functioning distractors. Total 13(43.33%), 7(23.33%) and 2(6.66%) items had three, two and zero functioning distractors respectively [13]. A recent study analyzed 30 MCQ with 90 distractors showed that 17(56.7%) items were with zero NFD (three functional distractors) and remaining 3 and 10 were with 2 NFD (two functional distractor) and 1NFD (two functional distractors) respectively [10].

Similarly, another recent study analyzing 40 MCQ with total 120 distractors, revealed that a number of items with three functional (0 NFD, DE=100%) distractors were as high as 26 [65%]. While items with two functional (1 NFD, DE=33%) distractors and with one functional (2 NFDs, DE=66%) distractor were 10(25%) and 4(10%) respectively [14]. High discrimination power with large number of functioning distractors is an effective way to improve the validity of examination. It can also efficiently assess the student performance. The quality assessment process can be helpful and can be enhanced with medical faculty development program conducted regularly for development of new standardized MCQs [16-17].

The purpose of LMS or e-learning tools in encouraging teaching and learning outside of the classroom environment seem to have been achieved by Google Classroom for this batch of students is achieved as indicated by high scores in table 1. Apart from score of the students, feedback questionnaire was also uploaded in google classroom and analysed for students' perception. The feedbacks of 40 students who had returned this assignment was analysed as it may give vital clue to how students' feel about the lecture class.

The questions were regarding the lecture delivery, accessibility, applicability, problem solving ability and technical issues. The questions regarding lectures like the format of lecture, understanding the concept, liking and enjoying the lecture and retention of knowledge were positively responded by the students. The accessibility and availability in various places and devices was most of the students agreed to. The applicability of knowledge in clinical situation particularly various mental disorders was explored and more than 50% students agreed that it will help in clinical application and understanding of pathophysiology of various diseases. Less than 50% students thought that it will help in problems solving. Less than 10% students had some technical issues as reflected by the response to such question. The technical issues faced by students will be analysed in open ended question in feedback.

This study also points to an important technological aspect where use of Google Classroom welcoming move for most of the students. This finding can be exploited to develop e-learning resources or LMS's which

can be accessed by students from comfort of their time and place on the device of their choice. With exponential rise in technology and average betterment of internet access and speed, LMS use medical colleges should be encouraged particularly for self-directed learning (SDL) as required by MCI [5]. It is also important to understand that emergency situation like COVID 19 pandemic or any such situation may arise in future, wherein student cannot attend medical college and in such situation elearning in medical education remain the only way of continuing medical education. Similar study was done by Dr of MAHE, Biochemistry Department [18]. He found Google Classroom to be very effective in driving the content except students faced some problem in submission of assignments.

The author has explained the difficulty in assignment submission very vividly that students were assigned to make certain illustrations on the topic of acid-base balance and upload the images on Google classroom. The tedious process of clicking photo using phone and uploading the relatively large file size was difficult. In present study, no students reported having any problem with technology, internet or the assignment submission. If we have designed some complex assignment, then it would have been different. The important aspects of e-learning which are often explored are the utility of the tool, the cost-effectiveness, privacy and satisfaction of learners.

Google classroom has all the basic components that make its utility high and effective tool for teaching. It is absolutely user friendly as reflected by students. It comes free of cost to use therefore it is cost effective. The learner or students' satisfaction is high as reflected by their score on Likert scale. Increased access to education, supplementary tools for faculty aiding in their teaching, increasing number of contributing resource persons, and resource sharing among students have been delineated as major reasons for investing in e-learning resources in LMICs [1]. In LMIC, although blended learning has been reported in many medical schools, use of LMS is rare. Google Classroom provides for an effective alternative to other costly products. Medical schools using e-learning employ blended learning as the most common computer assisted technology, and in that regard, Google Classroom can assist in enhancing faculty effectiveness and efficiency. In our setup, which does not use any LMS yet, curriculum can be tweaked to incorporate aspects of Flipped classroom using Google classroom, which also can facilitate spiral learning. The medical education, particularly in Physiology, benefit from such technological advancement. Cost-effectiveness aspect of use of Google classroom is what makes it most acceptable.

Using it in our settings neither imposed extra cost to students nor to the institution. No additional cost for creation of e-learning resources was incurred. To achieve economy of scale and which is suited for large and repeating classes, this is an effective LMS tool in most of the Indian settings. The use of Google Classroom can be further defined by using it for more topics and more subjects in Medical education. Further studies in uses of LMS will help in formulating guidelines for most Indian settings. LMS can facilitate personalization of learning, individualization of tracking, assessment, and the following required support. Google classroom is a means to and not an end in itself. The same applies to any learning management resource.

Limitations of this study include lack of testing for complex assessment. A Focus Group Discussion (FGD) could be done for students to understand its utility and limitation further. The stakeholder like teacher, their inputs and analysis can be studied through a questionnaire or focus group discussion. This will give an added dimension to using Google classroom as teaching tool particularly for self-directed learning and during the times when students cannot attend classes physically like the ongoing COVID 19 pandemic lockdown or any such natural or man-made emergency. It may also enlighten on unmet needs in medical education technology and faculty development program. Further implications and application of other platforms like Zoom, Moodle, etc should be studied in Indian settings in order to formulate guidelines for LMS in Indian settings.

Conclusion

Google classroom is a great platform for teaching Physiology as it improves and ensures learning in virtual settings.

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