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WhatsApp Assisted Learning versus Traditional Classroom Learning: A Crossover Study of Two Different Teaching Learning Methods in Undergraduate Medical Students

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Abstract

Background: Potential of WhatsApp as a medium for medical education has been studied but has not been widely assessed for its utility as a formal teaching-learning tool.

Objectives: To compare the effectiveness and to study the perception of learners and facilitators about WhatsApp Assisted teaching-learning and Traditional teaching-learning.

Methods: An interventional, cross-over study among 243 second year MBBS students was conducted. Control groups were taught by Traditional teaching while experimental groups were administered a predefined curriculum through a WhatsApp group prior to the classroom teaching. Module comprising of pre-defined academic material, voluntary guided visit to the experimental lab and provision for in-person discussion with designated faculty for queries. Learning evaluation included analysing utilisation of both teaching modules; pre/post-test questionnaires, analysis of student interactions during group discussions; assessment of practical assignments. The reaction of the students and faculty were collected through a feedback survey. Descriptive and analytical statistics were applied using IBM SPSS version 25.

Results: More than two-third students actively utilised WhatsApp module, while no student availed the provisions of Traditional teaching module prior to class. Experimental group showed higher pre-test scores than control group for one topic ($p<0.001$; $M_{diff}=2.80(0.48)$, 95% CI [1.86,3.75]; Hedges' $g_s= 0.84$, 95% CI [0.55,1.13]). However, there was no difference in the post-test scores for experimental and control groups. Group dynamics showed that higher proportion of students from the experimental group interacted within themselves ($p=0.03$; Difference in proportion=0.12, 95% CI [0.00, 0.23]) and with teachers ($p=0.004$; Difference in proportion=0.19, 95% CI [0.05, 0.33]). There were fewer incomplete assignments ($p<0.001$; Difference in proportion= -0.29; 95% CI [-0.40,-0.18]) and fewer mistakes in the experimental group. Majority of the students and faculty favoured WhatsApp Assisted learning and preferred as supplement to traditional methods (82.5%, n=189 and 100%, n=9 respectively).

Conclusion: WhatsApp Assisted teaching-learning may be useful tool for learning with Traditional teaching-learning. It improves the perceptions of the students towards their own learning abilities and enhances student-teacher interactions.

Keywords: WhatsApp Assisted Learning, M-Learning, E-learning, Blended Learning, Pharmacology

Introduction

A learning environment for active learning for undergraduate medical students involves providing various learning stimuli including dynamic learning activities creating sustained active learning environments requires teachers to give some personal attention to the students. However, Indian Medical Colleges have a large class size and traditional method of teaching like , didactic lectures are most common teaching-learning (T-L) method where sustained opportunities for active learning is always not possible.

Newer technology can break these barriers like computer, internet facilities can provide opportunity for e-learning. Mobile learning (M-learning) is an extension of E-learning(2) which makes it possible to share a wide array of study material such as text, images, audio/video lectures and 3D simulation videos. These can be accessed by the students in their own time and space, at their own pace. They can view and review the material as many times as they want, and can also connect with the teachers anywhere, anytime without the boundaries of time and place(3).

WhatsApp, as a platform for medical education, though not common in routine practice but studies have demonstrated that WhatsApp has a clear technical and logistic advantage as an M-learning tool due to its widespread presence and ease of use by the students and faculties. Existing studies on implementing a predefined WhatsApp curriculum are fewer as compared to research on use of WhatsApp without a predefined curriculum. Majority of these studies have evaluated up to Level 2 of the Kirkpatrick Model of Training Evaluation and utilized scores to evaluate learning.(4,5–8). Our literature search revealed that there is a dearth of research on WhatsApp as a medium of medical education blended with traditional T-L. Despite its immense popularity (400 million users in India alone), WhatsApp has not yet taken as a tool for mainstream learning aid.. To facilitate integration of WhatsApp assisted T-L into mainstream medical education, it is imperative to generate evidence regarding its utility in real-world settings.

Hence, we designed an Experimental Pharmacology module which introduces WhatsApp assisted T-L and,

compared it with the routine traditional T-L method. We attempted to compare and evaluate the two methods based on the perceptions of students and teachers, as well as evaluation of the students' learning, trying to move beyond the scores for evaluating learning.

Rationale for Study Procedure

This study is regarding the formal T-L activities that occur before and after the classroom teaching, targeted at enhancing the learning of the students. As per the existing traditional teaching practice (prevalent practice across the medical colleges in India) few days before the scheduled classroom teaching, the students are assigned the task of reading designated study material before they come to class, to prime them for classroom teaching. However, it was a common observation that majority of the students neither read the study material prior to classroom teaching, nor do they approach the faculty or avail the departmental laboratory/library facilities. Hence, we felt the need to develop, implement and evaluate a WhastApp assisted T-L method wherein students are primed for classroom teaching by sharing designated study material over WhatsApp, and they are also free to approach faculty over WhatsApp, instead of coming to the department to meet them in person. We hypothesised that introducing WhastApp as a formal T-L aid, might improve student learning, as well as increase their interest and enhance their learning experience.

Material and Methods

WhatsApp Teaching Module for Experimental Groups

- Two types of Short videos (three to four/day) not extending 10 minutes shared:
  - Videos from open access medical education websites
  - Simulation videos self-prepared and validated in the department using ExPharm for Windows 95/98 version T1.00, 1999, a software for simulated experiments in Pharmacology
- Three to four images/labeled diagrams from Pharmacology reference books or open access medical education websites were shared every day.
- WhatsApp text messages were used for sharing the objectives of the day, providing explanation of the videos/images, resolving queries and for conducting relevant discussions between the students and the faculty
- Question-answer sessions were conducted every day by sharing a Google Forms link on the WhatsApp group. The number of students responding to these questions through Google forms were analysed to study the utilization of the WhatsApp teaching module. The answers to the questions were posted on the WhatsApp group the next day through WhatsApp text messages

Traditional Teaching Module for Control Groups

The conventional teaching module had the following components

- Pharmacology practical workbook (Journal) prepared by the department of Pharmacology, consisting of the description of the relevant experimental pharmacology topic along with the practice exercises/questions
- Standard textbook for undergraduate medical students (Pharmacology and Pharmacotherapeutics, R.S Satoskar, Nirmala N. Rege, Raakhi K. Tripathi, S.D. Bhandarkar, 25th Edition) along with its online resources.
- Full time (9.00 am to 5.00 pm) availability of the nine designated faculty members recruited for the

study, for addressing any query relevant to the academic material shared or the experimental pharmacology lab.

Evaluation tools

- Questionnaire was prepared for each topic and used as pre and post-test questionnaires. Each questionnaire contained 10 multiple choice questions (MCQs), with two marks each..
- Checklist for evaluating the completed assignments submitted by the students for both the topics. The checklist consisted of answer key to the practical assignments and provision was made to record the errors in each assignment
- A feedback survey was created separately for the students and the facilitators. Student survey consisted of total 12 questions, where responses for nine questions were recorded on a five-point Likert scale and for three questions, answers were recorded as Yes/No with reason. Facilitator survey consisted of six questions. Responses for three questions were recorded on a five-point Likert scale and for the remaining three, as Yes/No/Neutral with reason. The Likert scale was scored as 1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, 5=Strongly disagree.

Study Procedure

This was an interventional crossover Study conducted at Department of Pharmacology at our institution over a period of eight weeks from February to March 2019 after approval from the Institutional Ethics Committee (vide letter ref. no. 20/2019 dated 25/2/2019). Second professional year MBBS students who gave written informed consent and had internet enabled smartphones with WhatsApp application were included in the study. The project was integrated with routine teaching activities of the department. Nine faculties (excluding investigators) of the department were included as facilitators and trained regarding the study methodology

After recruitment, the participants (n=243) were divided into two groups, A (n=120) and B (n=123)as per batches of routine teaching. Two Experimental Pharmacology topics (effects of drugs on eye; and general and local anesthetics) were selected for the study. For topic I, Group B was the experimental group, which was taught using the WhatsApp Assisted T-L method. Group A was the control group taught using the Traditional T-L method. For topic II, Group A was the experimental group and Group B was the control group. The practical classes were scheduled such that no contamination of the control group occurred with information shared with the experimental group over WhatsApp.

Both the teaching modules, Traditional and WhatApp, were implemented over one week prior to the scheduled practical classes for the control and experimental groups respectively, in a crossover design for two topics.

A WhatsApp teaching module was prepared and validated for each of the two topics by the Pharmacology subject experts and senior faculty members of the department. This module was administered through WhatsApp groups created comprising students in the experimental groups, all trained faculties and investigators. The predefined teaching module was administered through WhatsApp for seven days prior to the scheduled practical class. Guideline to avoid unprofessional behavior was also given.

A traditional teaching module was prepared for both the topics as per conventional teaching practices of the department. The module was implemented seven days prior to the scheduled practical class.

A traditional teaching module was prepared for both the topics as per routine teaching practices of the department. The module was implemented seven days prior to the scheduled practical class.

For Traditional T-L method, designated faculties were available in the classroom and in the department during the office hours for in-person discussion/doubt solving. For the WhatsApp Assisted T-L, faculties were available from 8 a.m. to 8 p.m. on WhatsApp for virtual discussion/doubt solving. The submitted practical assignments were evaluated using a pre-validated checklist.

The practical classes were scheduled separately for the experimental and control groups**,** with each class having a class size of around 60, to prevent overcrowding. On the day of the scheduled practical class, both the groups were administered a pre-test questionnaire, before the class began. Practical class was conducted as usual, using the Chalk and Board method followed by practical demonstration for the topic selected. All the practical classes for the study were conducted by the investigator, using same content material for experimental and control groups, to maintain comparability and uniformity. For experimental groups, the material shared on WhatsApp was reviewed in the class, on students' request.

The students in each practical class were then divided into five sub-groups for group activities involving discussions on the topic covered. The discussions were facilitated by the nine faculty facilitators (excluding investigators). The learner interactions within each subgroup were observed and recorded by the respective facilitator in form of sociograms. These sociograms were analysed to study the group dynamics. The group activities were followed by the administration of a post-test questionnaire to the students.

Following this, students were given an assignment based on the practical topic covered and instructed to submit within seven days of the practical class.

After both the topics were covered, students and facilitators were administered a feedback survey regarding both T-L methods used during the study.

Outcome evaluation

The evaluation of the learning outcomes was classified as per the Kirkpatrick Model of Training Evaluation(8-10). Evaluation of learning i.e. Level 2 of the Kirkpatrick Model was done using the following:

- Utilization of teaching modules before the scheduled practical class: (1) WhatsApp teaching module : by noting the number of students who responded to the questions asked on WhatsApp or interacted on WhatsApp group at least once. (2) Traditional teaching module : by noting the number of students who scheduled a guided visit to the pharmacology lab or scheduled an appointment with designated faculty for query resolving or visited the departmental library to access the textbook/reference book/online resources
- Pre and post-test questionnaires
- Student's participation in group discussions: Assessed using sociograms drawn by the facilitators during the groups' discussions after the classroom teaching. The sociogram revealed the number of times a student interaction with other student or to the facilitator
- Practical assignments assessment: Questions and exercised based on the respective experimental pharmacology topic were evaluated with checklist
- The feedback from the learners and the facilitators was used to evaluate the Reaction i.e. Kirkpatrick Model Level 1 .

Statistical Analysis

The data was entered in MS Excel 2010 and statistical analysis was done using IBM SPSS Version 25. The values are presented as number and percentage values for qualitative variables, and as mean and standard deviation (SD) for quantitative variables. For comparing unpaired quantitative data, independent samples t-test was applied, and for paired quantitative data, paired t-test was applied(11). To maintain uniformity, in the independent samples t-test, we have subtracted control values from experimental values and in paired t-test, we have subtracted baseline values from end line values. Proportions were compared through difference between proportions using WINPEPI PROGRAMS COMPARE2 Version 3.85 © J.H. Abramson(12). We have provided difference of interest along with effect sizes and 95% confidence intervals to enable comparison with similar studies(13). For independent samples t-test, we have reported Hedges' g_s and for paired t-test we have reported Hedges' g_{av}(14–16). The significance threshold was set at 0.05, two-tailed for all hypothesis testing.

Results

Students' Characteristics: Out of the 243 eligible students, three were absent for classroom teaching in both the topics and hence were excluded from the analysis. Mean age of students was 18 (SD=2.8) years and 67(27.6%) female students in our study. Students who attended at least one topic were included for assessing utilization of teaching modules and assignment analysis. Students who attended both the topics were included for score analysis. The details of inclusion of students for various levels of analysis are shown in Table 1.

Table 1: Students included for various levels of analysis

	Group A	Group B	Remarks
Total Students	120	123	
Absent in both topics	0	3	Excluded from all analysis
Participants Included in final study	120	120	Included for assessing utilization of teaching modules and assignment analysis
Topic I	Control Group (n=120)	Experimental Group (n=120)	
Present	109 (90.8%)	108 (90.0%)	Included in analysis of participation in group discussion
Absent	11 (9.2%)	12 (10.0%)	
Topic II	Experimental Group (n=120)	Control Group (n=120)	
Present	110 (91.7%)	108 (90.0%)	Included in analysis of participation in group discussion
Absent	10 (8.3%)	12 (10.0%)	
Present in both topics	99 (82.5%)	96 (80.0%)	Included for score analysis
Student feedback	189 out of 240 responded (78.8%)		Included for feedback analysis

Kirkpatrick Level 2: Evaluating Learning

Analysis of utilization of teaching modules administered prior to scheduled practical classes:

Experimental Group (WhatsApp teaching module) (n=120): 58 (48.3%) students in topic I and 43 (36.5%) students in topic II participated in the WhatsApp group interactions and answered questions.

Control Group (Traditional module) (n=120) : no student from any group visited to the pharmacology lab or accessed any book/online resource from the departmental library or scheduled an appointment with designated faculty for discussion/query resolving prior to the scheduled class.

Score Analysis: In both the topics, the post-test scores were significantly higher than the pre-test scores for experimental as well as control groups.

For topic I, there was no significant difference in pre-test scores of the experimental and control groups ($t_{(193)}$=0.415, p=0.68, M_{diff}=0.21; 95% CI [-0.77,1.19]; Hedges g_s=0.06, 95% CI [-0.22,0.34]). However, for topic II, the pre-test scores of the experimental group was significantly higher than e control group. ($t_{(193)}$=5.860, p<0.001, $M_{diff=}$2.80(0.48); 95% CI [1.86,3.75], Hedges $g_{s=}$0.84; 95% CI [0.55,1.13]).

There was no significant difference between post-test scores of experimental and control groups for both the topics. (Table 2 and 3).

Table 2: Score analysis for pre and post-test questionnaires for Topic I.

		Group A (n=99)	Group B (n=96)	Comparison between the groups (Group A vs Group B)		
	Topic I	Control Group Mean score (SD)	Experimental Group Mean score (SD)	Independent samples t- test	Mean Difference (Standard error difference); 95% CI	Effect Size† (95% CI)
	Pre-test score	4.92 (3.52)	5.13 (3.41)	$t_{(193)}$=0.415, p=0.68	0.21(0.50); 95% CI [-0.77,1.19]	0.06; 95% CI [-0.22,0.34]
	Post-test score	10.88(4.29)	10.32(4.18)	$t_{(193)}$= -0.924, p=0.36	-0.56(0.61); 95% CI [-1.76,0.64]	-0.13;95% CI [-0.41,0.14]
Comparison within the groups (Pre-test vs Post-Test)	Paired t-test	$t_{(98)}$=15.357, p<0.001*	$t_{(95)}$=16.131, p<0.001*			
	Mean Difference (SD); 95% CI	5.95(3.86); 95%CI 5.19,6.72]	5.19(3.15); 95%CI [4.55,5.83]			
	Effect Size† (95% CI)	1.51; 95% CI [1.23,1.80]	1.35; 95% CI [1.10,1.61]			

*indicates statistically significant difference, with p-value lower than 0.05

†Effect size used is Hedges' $g_s$for independent sample t-testand Hedges' g_{av} for paired t-test

Table 3: Score analysis for pre and post-test questionnaires for Topic II.

		GroupA (n=99)	Group B (n=96)	Comparison between the groups(Group A vs Group B)		
	Topic II	Experimental GroupMean score (SD)	Control Group Mean score (SD)	Independent samples t- test	Mean Difference (Standard error difference); 95% CI	Effect Size† (95% CI)
	Pre-test score	10.42(3.79)	7.61(2.80)	$t_{(193)}$= 5.860, p<0.001*	2.80(0.48); 95%CI [1.86,3.75]	0.84; 95% CI [0.55,1.13]
	Post-test score	14.93(3.48)	14.08(3.69)	$t_{(193)}$=1.657, p=0.10	0.85(0.51); 95%CI [-0.16,1.86]	0.24; 95% CI [-0.04,0.52]
Comparison within the groups (Pre-test vs Post-Test)	Paired t-test	$t_{(98)=}$14.201, p<0.001*	$t_{(95)}$=17.996, p<0.001*			
	Mean Difference (SD); 95% CI	4.51(3.16) 95%CI [3.88,5.15]	6.47(3.52); 95%CI [5.75,7.18]			
	Effect Size† (95% CI)	1.23; 95% CI [0.99,1.48]	1.96; 95% CI [1.62,2.33]			

*indicates statistically significant difference, with p-value lower than 0.05

†Effect size used is Hedges' $g_s$for independent sample t-testand Hedges' g_{av} for paired t-test

Sociogram Analysis for Group Discussions: (1) Topic I: significantly higher proportion of students interacted among themselves in experimental group as compared to the control group (p=0.03, Difference in proportion=0.12; 95% CI [0.00, 0.23]). (2) Topic II: significantly higher proportion of students from experimental group interacted with faculty facilitator as compared to control group (p=0.004, Difference in proportion=0.19; 95% CI [0.05, 0.33]). (Table 4)

Table 4: Learner interactions during group discussions for experimental and control groups in both topics

	Topic I				Topic II			
	Control Group (n=109)	Experimental Group (n=108)	p	Difference between proportion [95% CI]	Control Group (n=108)	Experimental Group (n=110)	p	Difference between proportion [95% CI]
Silent Students	23 (21.1%)	17 (15.7%)	0.31	-0.05 [-0.17, 0.06]	17 (15.7%)	23 (20.9%)	0.32	0.05 [-0.06, 0.16]
Vocal	86 (78.9%)	91	0.31	0.05	91	87	0.32	-0.05

Students		(84.3%)		[-0.06, 0.17]	(84.3%)	(79.1)		[-0.16, 0.06]
Students who interacted with faculty	76 (69.7%)	83 (76.9%)	0.24	0.07 [-0.05, 0.20]	56 (51.9%)	78 (70.9%)	0.004*	0.19 [0.05, 0.33]
Students who interacted with other students within group	79 (72.5%)	91 (84.3%)	0.03*	0.12 [0.00†, 0.23]	82 (75.9%)	87 (79.1%)	0.57	0.03 [-0.09, 0.15]

*indicates statistically significant difference, with p-value lower than 0.05

†All CI values have been rounded-off to two decimal points. Hence lower limit of CI as 0.00 does not mean that CI includes 0

Practical Assignment Assessment: There was no significant difference for assignment submission between experimental and control groups in topic I. For topic II, significantly higher proportion of students from control group submitted their assignments as compared to experimental group (p<0.001, Difference in proportion=-0.20, 95% CI [-0.30,-0.10]). However, from among the submitted assignments (experimental group=86, control group=110), the proportion of incomplete assignments (experimental group=12[13.9%], control group=47[42.7%]) was significantly higher in control group as compared to experimental group (p<0.001, Difference in proportion= -0.29, 95% CI [-0.42,-0.16]). Similar number of errors in assignments of experimental and control groups in topic I while less than half the assignments in the experimental group had any errors, while there was at least one error per assignment in the control group in topic II was observed. (Table 5)

Table 5: Analysis of practical assignments submitted by experimental and control groups for both topics

	Topic I				Topic II			
	Control Group (n=120)	Experimental Group (n=120)	p	Difference between proportion [95% CI]	Control Group (n=120)	Experimental Group (n=120)	p	Difference between proportion [95% CI]
Complete assignments	79 (65.8%)	82 (68.4%)	0.68	0.03 [-0.10,0.15]	63 (52.5%)	74 (61.7%)	0.15	0.09 [-0.04,0.23]
Incomplete assignments	28 (23.4%)	26 (21.7%)	0.76	-0.02 [-0.13,0.10]	47 (39.2%)	12 (10.0%)	<0.001*	-0.29 [-0.40,-0.18]
Total submitted assignments	107 (89.2%)	108 (90.0%)	0.83	0.01 [-0.08,0.09]	110 (91.7%)	86 (71.7%)	<0.001*	-0.20 [-0.30,-0.10]
Assignment	13	12	0.83	-0.01	10	34	<0.001*	0.20

not submitted	(10.8%)	(10.0%)		[-0.09,0.08]	(8.3%)	(28.3%)		[0.10,0.30]
Total errors in submitted assignments	45	42			129	41		

*indicates statistically significant difference, with p-value lower than 0.05

†All the percentages are calculated with denominator n=120

Kirkpatrick Level 1: Evaluating Reaction

Feedback was given by 189(78.7%) (n= 240) for WhatsApp Assisted T-L method. Out of these, 138(73.0%) felt that WhatsApp Assisted T-L led to better understanding of the topic being taught in classroom and 92(48.7%) felt that it enabled increased interaction of students with faculty and motivated students for self-directed learning(95[50.3%]). Students believe it will also help them in clinical practice in the future (105[55.6%]). Majority of the students felt that such e-learning should supplement the didactic lectures (156[82.5%]), but not replace them completely (141[74.6%]). (Table 6)

Faculty feedback for WhatsApp Assisted T-L, six faculties (n=9) felt that it led to better understanding of the topic among the students and four teachers expected students to score better for topics taught using this T-L method. All faculties agreed that it should not replace the didactic lectures completely, but should supplement them instead. -(Table 6)

Table 6: Student feedback and faculty feedback on WhatsApp Assisted teaching-learning method.

Questions regarding WhatsApp Assisted T-L Method	Strongly Agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly Disagree n (%)	No response n (%)
Students' feedback (n=189)						
Better understanding of topic	42(22.2%)	96(50.8%)	40(21.2%)	5(2.6%)	5(2.6%)	1(0.5%)
Increased interactions between students and teachers	22(11.6%)	70(37.0%)	49(25.9%)	38(20.1%)	10(5.3%)	0(0.0%)
The teaching was satisfactory	21(11.1%)	100(52.9%)	51(27.0%)	8(4.2%)	3(1.6%)	6(3.2%)
Comfortable with WhatsApp being used for academic purpose	48(25.4%)	74(39.2%)	50(26.5%)	12(6.3%)	5(2.6%)	0(0.0%)
Easy to understand and navigate	49(25.9%)	92(48.7%)	38(20.1%)	5(2.6%)	4(2.1%)	1(0.5%)
Provide motivation for self-directed learning	41(21.7%)	54(28.6%)	69(36.5%)	16(8.5%)	8(4.2%)	1(0.5%)
Helpful in clinical practice	21(11.1%)	84(44.4%)	63(33.3%)	12(6.3%)	9(4.8%)	0(0.0%)
Expect to score better in the	39(20.6%)	82(43.4%)	54(28.6%)	9(4.8%)	4(2.1%)	1(0.5%)

topic						
Encouraged to attend the lectures	24(12.7%)	44(23.3%)	73(38.6%)	26(13.8%)	22(11.6%)	0(0.0%)
	Yes			No		No response
Replace didactic teaching with such e-learning	44(23.3%)			141(74.6%)		4(2.1%)
Supplement didactic lectures with such e-learning	156(82.5%)			32(16.9%)		1(0.5%)
Books are more useful for self-directed learning than internet	135(71.4%)			45(23.8%)		9(4.8%)
Faculty feedback (n=9)						
	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree	No response
Better understanding of topic	2(22.2%)	4(44.4%)	3(33.3%)	0(0.0%)	0(0.0%)	0(0.0%)
Increased interactions between students and teachers	1(11.1%)	2(22.2%)	4(44.4%)	2(22.2%)	0(0.0%)	0(0.0%)
Expected students to score better in the topic	0(0.0%)	4(44.4%)	4(44.4%)	1(11.1%)	0(0.0%)	0(0.0%)
	Yes		Neutral	No		No response
Such e-learning model is not useful and should be removed	0(0.0%)		0(0.0%)	9(100.0%)		0(0.0%)
Such e-learning should supplement didactic lectures, not replace them	9(100.0%)		0(0.0%)	0(0.0%)		0(0.0%)
Textbooks are more useful for self-directed learning than the internet	1(11.1%)		6(66.7%)	2(22.2%)		0(0.0%)

Discussion

Present study shows that students in both experimental and control groups were similar in their post-test scores and in compliance with submitting assignments. However, the pre-test scores of the experimental group were either si milar to, or significantly higher than pre-test scores of the control groups; more than one-third students utilized the WhatsApp module, while no student availed him/herself to the provisions of the traditional teaching module; a higher proportion of students from the experimental group interacted with each other and with teachers; among those who did submit their assignments, the experimental group had fewer incomplete assignments and fewer errors than the

control group; and most students and faculty favoured WhatsApp Assisted learning.

The utilization pattern of the two teaching modules in this crossover study reflects a commonly encountered phenomenon that young learners often choose WhatsApp as a preferred mode of communication, vis-à-vis communicating in-person. This is an opportunity to Explore its utility as an educational tool (5). Effective priming before classroom teaching promotes self-directed learning and improves understanding during the classroom. WhatsApp has shown to be an effective and convenient platform for priming the students prior to class, as is shown in the our study and other similar studies (6). Evaluated over short term, WhatsApp Assisted T-L may not lead to significant knowledge improvements as compared to Traditional T-L (5). However, over long term, students' performance has been shown to be higher where online learning is blended with face-to-face instruction, as compared to when the instructions are given purely face-to-face or purely online(4,17).

In a group discussion, more than one-third students in the experimental groups interacted with faculty over WhastApp prior to class, and also demonstrated more frequent interactions in group discussions after the class. This supports that WhatsApp has the potential to deconstruct hierarchy, enhancing in-person interactions as well, learners can freely interact with the faculty, without hesitance, enhancing their learning experience (18,5). However, it is important to provide clear guidelines regarding acceptable behaviors at the onset of the WhatsApp group formation to avoid unprofessional behavior, as was done in the current study (9). An additional advantage of WhastApp assisted T-L is the convenience of getting the doubts resolved instantly and remotely through WhatsApp interaction with faculty(19). During traditional method, students need to wait to meet the faculty in-person, where the student might not make the extra efforts and could be left with unresolved doubts. This could be a factor contributing to higher proportion of incomplete/incorrectly written assignments in the control groups.

Findings of the learning evaluation are supported by the findings of the reaction evaluation of the Kirkpatrick model. In terms of the technical and logistic aspects, majority of the students were comfortable using WhatsApp as an academic platform and found it easy to understand and navigate. Majority of the students also reported better understanding of the topic. They not only expected to score better in the topics taught using WhatsApp Assisted module, but also felt that such innovative T-L will help them in their future clinical practice. This could be because techniques, including e-learning, which are known to stimulate curiosity regarding the topic among the students before the actual class, are effective in making the lessons "sticky" i.e. comprehensible and memorable(3,6).

However, medicine is a competency based science, where the human touch, figuratively and literally, is irreplaceable. Hence completely relying on e-learning is not an option. However, blended learning can be adapted to provide the better opportunity of leaning to the medical students. This is reflected by majority students and faculties, who have reported that such e-learning should supplement Traditional T-L, not replace it. Also, it is interesting to note, majority of students reported that they would prefer textbooks against online sources for self-directed learning. This could be because, without faculty to curate the available sources, online resources can easily lead to overwhelming information overload.

Hence, in today's technology driven medical education scenario, it is important that the learner-centric teacher must adapt the role of being curator of information and facilitator of learning, apart from performing the traditionally assigned role of being provider of information(21).

Certain disadvantages of WhatsApp widely reported in literature include faculty being disturbed at odd hours, flooding of the group with messages and, information overload(7,20). However, these issues were addressed to some extent by limiting within time duration for the WhatsApp group activity; sharing academic material strictly as per the pre-defined WhatsApp module to prevent information overload; by collecting student responses through Google forms link to avoid unnecessary message load in the WhatsApp group. Also, in the current study, the teacher time invested in administering WhatsApp assisted learning, including solving student queries, was limited to less than 20 minutes per day per facilitator, to avoid undue burdening of the teachers. It was observed to be adequate for addressing all the queries that came over WhatsApp.

It is worth noting at this stage, that as a lasting impact of this research, the WhatsApp groups created for this study have remained functional even after the completion of the intervention. The WhatsApp groups are constantly used by the faculty to implement modules for various topics. Doubt solving and discussions also regularly occur between students and teachers. Hence, WhatsApp Assisted T-L has become a part of routine departmental teaching activities.

Limitations

The major limitation of our study was that it was a short-term study. Benefits or ill-effects of blended learning may become more clearly evident if is implemented over a prolonged duration. Secondly, our study lacks a qualitative component, which would have been better suited to evaluate the perception of the students and faculty regarding the Traditional and WhatsApp Assisted T-L methods. Thirdly, the questionnaire used for pre and post-test was the same. It could have led to false high scores in post-test as students would focus on questions asked in the questionnaire. However, to minimise this bias, we had allotted 50% marks to justification for the choice made in MCQs for majority of the questions. This enabled us to evaluate whether the students truly understood the rationale behind the answer, or were answering simply because they remembered the MCQ from the pre-test. Also, we jumbled the order of the questions in the pre and post-test version of the questionnaires.

Conclusion

WhatsApp Assisted T-L does not give any clear advantage over Traditional T-L but it may have following clear advantages over Traditional T-L:

1. Can be an effective priming tool for students regarding a topic to be taught in an upcoming traditional class and facilitates student-teacher interactions prior to class as well as in-class discussions by appearing to deconstruct hierarchy
2. Facilitates positive perceptions of students towards their own learning abilities. They feel that it motivates them for self-directed learning, makes them want to attend the classes and makes teachers more accessible. All these factors combined, make students perceive an improvement in their understanding of the topic and hence, they see it as beneficial to their future as doctors. These favourable perception of the students may lead to tangible learning gains over long term. Further

research is required with focus on the long term effects of such WhatsApp Assisted learning

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