

# Effectiveness of Whatsapp as a Teaching Learning Tool for Problem Based Learning in Pharmacology: A Quasi-experimental Study

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## ABSTRACT

**Introduction:** Instant Messaging Applications (IMAs) like Whatsapp has changed our lives including medical education in many ways.

**Aim:** To explore and compare the effectiveness and acceptability of Whatsapp as a Teaching Learning (TL) tool for Small Group Learning (SGL) sessions when compared with traditional classroom based learning SGL sessions, for a specific topic (pharmacokinetics) in Pharmacology in Problem Based Learning (PBL) sessions.

**Materials and Methods:** This quasi-experimental study was conducted in a tertiary care government medical college in Eastern India on second phase Bachelors of Medicine and Bachelor of Surgery (MBBS) students in the year 2021 over a period of five weeks (from March to April 2021). After Didactic Lecture (DL) on the topic, the willing students were randomly divided into two groups, group A (n=46) and group B (n=45). Then group A and group B students attended classroom based and Whatsapp based SGL sessions, respectively, for a period of five consecutive days on "Pharmacokinetics" using PBL method. Students appeared for a Multiple Choice Question (MCQ) based

examination (predecided and prevalidated) of 30 marks before and after the SGL sessions. Next, group A students attended Whatsapp based PBL session on the same topic in the same manner as group B and vice-versa. Finally the students filled in a feedback form using a 5-point Likert scale.

**Results:** The post-test scores for both the groups were significantly better compared to the pretest scores; however, there were no significant differences in the post-test scores of both the groups. Regarding students' feedback on the type of SGL, except for enjoyment (p-value=0.0345) and interactiveness (p-value=0.022), there were no significant differences between the two group scores. The students significantly preferred combination of both types of SGL to either of them (p-value=0.001).

**Conclusion:** In this study, Whatsapp based SGL showed comparable effectiveness as classroom based SGL as measured in terms of MCQ based examination scores. Except for interactiveness and interest, classroom based SGL was equally acceptable to the students as Whatsapp based SGL. Interestingly, the students preferred a combination of both the type of SGL to either of them on the particular topic of Pharmacology.

**Keywords:** Didactic lecture, Instant messaging applications, Multiple choice questions, Online learning, Pharmacokinetics

## INTRODUCTION

Smartphones and improved access to internet (both in terms of affordability and availability) have reshaped our lives including medical education in many ways [1-3]. Among all the social media platforms, Instant Messaging Applications (IMAs) hold a special place because of easy accessibility anywhere and anytime, storage of earlier chats and resource materials, easy archiving and retrievability, and most importantly availability of all the features at free of cost. Whatsapp is a very popular IMA, especially among the young adults, therefore, underlining its huge potential as a TL tool in medical education [4,5].

The National Medical Commission (NMC) has revised the previous undergraduate medical curriculum and has implemented the new competency based undergraduate curriculum from the month of August 2019. In the said curriculum booklets, special emphasis has been attributed to SGL sessions and Self-Directed Learning (SDL) sessions [6].

The PBL is already an established way of Teaching and Learning Material (TLM) in medical education [7-10]. Liu L et al., published a meta-analysis exploring the effect of PBL in pharmacology education. The researchers concluded from the 37 controlled trials that PBL showed a significant positive effect on theoretical examination score as assessed by examinations. Also, they found from students' feedback that PBL helps to arouse learning interest, team spirit, analysing and problem solving aptitude and finally motivate for SDL [7].

Although literature review revealed that Whatsapp has already been used as TL platform in postgraduate and undergraduate medical

education both in India and abroad [4,11-13] however, there are no published studies comparing the effectiveness and acceptability of classroom based SGL and Whatsapp based SGL sessions among undergraduate students in Pharmacology.

In this study, authors aimed to explore and compare the effectiveness, as assessed by MCQ based test scores and students' feedback, as assessed by 5 point Likert scale score, of classroom based SGL sessions and Whatsapp based SGL sessions on a specific topic (Pharmacokinetics) of Pharmacology.

## MATERIALS AND METHODS

After obtaining ethical clearance (number: DHGMC/2021/981 dated 21/02/2021) this quasi-experimental study was conducted in our college (a tertiary care government medical college in Eastern India) among the second phase MBBS students (Session 2021-2022) over a period of five weeks (from March to April 2021).

**Sample size calculation:** Considering the inclusion and exclusion criteria, 91 students were included in the study (there are 100 students in the year 2020-21, 2<sup>nd</sup> phase MBBS batch) and were divided randomly into two groups (group A and group B; n=46 and 45, respectively) to attend the SGL sessions. group A students (n=46) attended classroom based SGL sessions using PBL and group B students (n=45) attended Whatsapp based SGL sessions using PBL.

**Inclusion criteria and Exclusion criteria:** The study included second phase MBBS students (2021-22), students willing to participate in the study and those who had smartphone with internet connection.

Also, students willing to use Whatsapp were included in the study and students those who did not gave consent were excluded from the study.

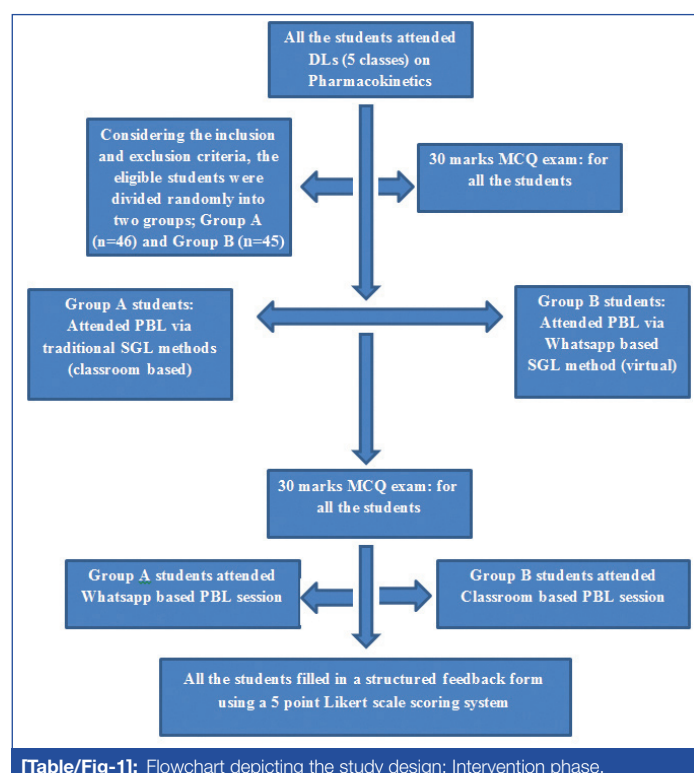
The faculty of the Department of Pharmacology participated as the facilitators in the TL study. The study was conducted in the following three phases:

### Sensitisation Phase

Although Whatsapp is widely used among students, they were not familiar with the use of Whatsapp as a TL platform for PBL. Hence, a 30 minute long offline sensitisation program was conducted for the students regarding how Whatsapp was going to be used as a TL platform for PBL.

### Intervention Phase [Table/Fig-1]

**Didactic Lectures (DL) and SGL:** All the students attended DL on pharmacokinetics. The topic of pharmacokinetics was divided on the basis of the competency based undergraduate curriculum guidelines laid down by the NMC under five sessions of DL namely absorption, distribution, metabolism, excretion of drugs and calculation of the dosage of drugs using appropriate formulae for an individual patient, including children, elderly and patient with renal dysfunction.



### Assessment and Evaluation Phase

After the end of the five sessions of DLs, the students took an offline supervised MCQ based test of 30 marks of 35 minutes duration (without any access to any resources offline or online).

### Classroom Based PBL Sessions

The group A students were further divided into two groups of 23 students each (group A1 and group A2) and each group attended classroom based PBL sessions (of 45 minutes duration) by one facilitator (TS) for the same five consecutive days on different time slots. The students were given a problem from the topic of pharmacokinetics at the beginning of the session. They were given 10 minutes to write the answers with the explanations. They were allowed to discuss among themselves and consult resources (both online and offline). For the next 20 minutes each of the students presented their answers with explanations. In the last 5 minutes, the facilitator presented the answers with the explanations. Finally in the last 10 minutes the students were encouraged to clear doubts (if any) on the said topic and the facilitator concluded the session.

### Whatsapp Based PBL Sessions

The participating students (Group B) were divided into two groups (Group B1 and Group B2; n=23 and 22, respectively) for ease of conducting Whatsapp based PBL sessions over a period five days, (from Monday to Friday) for 1 week. A second facilitator (PS) conducted these sessions. In the morning the facilitator posted a problem in the form of text (already predecided and validated by the faculty members of the Department of Pharmacology) from one of the topics from the Pharmacokinetics at 9 AM, the students then posted the solutions to the problem with explanations. Finally, when majority of the students posted their answers, the facilitator provided the solution along with the explanation. During the sessions, the facilitator often posted hints along with the problem to encourage participation from the students. It is to be noted that the discussion was not structured and it was open ended. The students were also allowed to ask questions pertaining to the problem posted or any other doubts they might have on the same topic. The discussion continued till 5 PM with concluding post on the topic from the facilitator.

It is to be noted that the same problem from the same topic was discussed (predecided by the faculty members of the Department of Pharmacology) in both the classroom based SGL session for group A students and also for the Whatsapp based SGL session for the group B students. The two sessions (classroom based session for group A and Whatsapp based session for group B) ran on the same five consecutive days, but on different time slots and was conducted by two different facilitators (TSK and PS, respectively). In this way, at the end of the SGL sessions (both the Whatsapp based PBL sessions, and the classroom based PBL sessions), all the students (both group A and group B) sat for an offline supervised MCQ based examination (of 35 minutes duration) of 30 marks without any access to any resource material offline or online on a predecided date. It is to be noted that once the study ended, group A students attended Whatsapp based PBL sessions and group B students attended Classroom based PBL sessions on pharmacokinetics with predecided and prevalidated problems. The problem set was different from that used in the earlier session. The students then filled in a structured feedback form using a 5-point Likert scale scoring system.

### STATISTICAL ANALYSIS

Data was presented in terms of mean±Standard Deviation (SD), the actual number of students, and in terms of percentage. Paired t-test was applied to compare the scores of pre and post-tests within the same group and unpaired t-test was used to compare between the scores of the two groups. The p-value less than 0.05 was considered to be statistically significant with 95% confidence interval.

### RESULTS

The students evaluated the SGL sessions on the following points- understanding, enjoyment, usefulness, interest, and interactiveness. [Table/Fig-2a] shows the students' response regarding the two SGL sessions (classroom based and Whatsapp based) as measured using a 5-point Likert scale (score 5 is the highest score whereas score 1 is the lowest score). Comparison of the Likert scale scores of the two groups of students (group A and group B) revealed that except for enjoyment and interactiveness (p-value=0.0345 and p-value=0.022, respectively) there were no significant differences in the two group Likert scale scores [Table/Fig-2a].

Next, in the [Table/Fig-2b] authors compiled the total Likert scale scores of the two groups together regarding preference for type of SGL, (classroom based, Whatsapp based SGL or for both). Comparison of Likert scale scores on these three parameters revealed that there were no significant differences in the total Likert scale scores regarding classroom based SGL and Whatsapp

Parameters	Scores	No. of students (Group A)	Mean±SD	No. of students (Group B)	Mean±SD	p-value
Understanding	5	15	4.065±0.800	18	4.29±0.66	0.138
	4	20		22		
	3	10		5		
	2	1		0		
	1	0		0		
Enjoyment	5	13	3.89±0.87	17	4.24±0.67	0.034
	4	17		22		
	3	14		6		
	2	2		0		
	1	0		0		
Usefulness	5	20	4.26±0.7434	22	4.4±0.65	0.346
	4	18		19		
	3	8		4		
	2	0		0		
	1	0		0		
Interest	5	19	4.07±0.99	24	4.33±0.825	0.191
	4	16		16		
	3	6		5		
	2	5		0		
	1	0		0		
Interactiveness	5	20	4.26±0.80	30	4.51±0.59	0.022
	4	20		13		
	3	4		2		
	2	2		0		
	1	0		0		

**[Table/Fig-2a]:** Students' response regarding classroom based SGL and Whatsapp based SGL using: 5-point Likert scale scores.  
Statistical test used: unpaired t-test; p-value <0.05 considered significant

based; however, both the groups of students significantly preferred combined method of SGL (both classroom based and Whatsapp based) to one of them (either classroom based or Whatsapp based) (p-value=0.001, for both classroom based SGL vs combined SGL; and Whatsapp based SGL vs combined SGL).

Parameters	Preference for classroom based SGL (a)	Preference for Whatsapp based SGL (b)	Preference for both (c)
Scores (Mean±SD)	4.275±0.716	4.329±0.684	4.824±0.383
Groups	a vs b	a vs c	b vs c
p-values	0.5972	0.001	0.001

**[Table/Fig-2b]:** Comparison of total Likert scale scores of all the students (from both the groups) regarding the type of SGL (Classroom based, Whatsapp based or both).  
Statistical test applied: unpaired t-test; p-value <0.05 considered significant

[Table/Fig-3a] show the pretest and post-test MCQ based exam scores of both the groups of students. In both the groups (group A and group B), post-test scores (after either classroom based SGL or Whatsapp based SGL) were significantly higher compared to the corresponding group's pretest scores (p-value=0.001).

Student groups	MCQ test scores		p-value
	Pretest (after DL) (Mean±SD)	Post-test (after SGL) (Mean±SD)	
Group A	11.935±3.058	21.043±2.616	0.001
Group B	11.956±2.540	21.778±1.717	0.001

**[Table/Fig-3a]:** Comparison of MCQ test scores: intragroup comparison (pretest vs post-test for both Group A and Group B).  
Statistical test applied: paired t-test; p-value <0.05 considered significant

However, comparison between pretest and post-test scores between the two groups (inter group comparison group A vs group B),

revealed no significant difference both for pretest and post-test scores [Table/Fig-3b].

MCQ test scores (Mean±SD)	Student groups		p-value
	Group A	Group B	
Pretest	11.935±3.058	11.956±2.540	0.965
Post-test	21.043±2.616	21.778±1.717	0.117

**[Table/Fig-3b]:** Comparison of MCQ test scores: intergroup comparison (Group A vs Group B).  
Statistical test applied: unpaired t-test

## DISCUSSION

In this comparative study on TLMs authors compared the effectiveness of Whatsapp based PBL and classroom based PBL in terms of pretest and post-test scores. Authors also assessed the students' feedback on a 5-point Likert scale (scores from 5 to 1) on the following points namely understanding, enjoyment, usefulness, interest, interactiveness, preference for classroom based SGL, Whatsapp based SGL, and both.

Except for "enjoyment" (p-value=0.0345) and "interactiveness" (p-value=0.022), there were no significant differences between the two groups Likert scale scores [Table/Fig-2a]. Again, comparison between the total Likert scale scores for preference regarding the type of SGL (classroom based, Whatsapp based, or both) revealed that all the students significantly preferred both types of SGL, classroom based and Whatsapp based (p-value=0.0001) together, to single type of SGL (either classroom based or Whatsapp based) [Table/Fig-2b].

Recently one similar study was conducted by Grover S et al., on 2<sup>nd</sup> phase MBBS students, on Case Based Learning (CBL) using Whatsapp and DL as a teaching platform. Also, the researchers noted (using focused group discussion) that students Whatsapp based discussions not only piqued their interest in pathology but also facilitated better retention of knowledge. Grover S et al., also documented higher post-test (after Whatsapp based CBL) MCQ scores compared to pretest MCQ scores (after only DL) [13]. In our study, MCQ based test scores revealed significant improvement (p-value=0.001) for both the groups in terms of scores following both DL and SGL compared to only DL [Table/Fig-3a]. However, there was no significant difference in pretest and post-test scores in both the groups of students [Table/Fig-3b].

In another study, conducted in India by Kapoor A et al., the researchers explored the acceptability and efficacy of Whatsapp as a TL platform in terms of promotion of problem solving skills and self-study among undergraduate medical students [14]. The researchers used case based approach (paediatric cases) on a particular topic (cardiovascular system) where, for a period of 5-7 days, they posted a clinical case in the Whatsapp group with some trigger questions. At the end of the session, knowledge was significantly improved as evident by significantly higher post-test scores [14]. The participants feedback was evaluated using Likert scale scores, similar to our study, revealing that majority of them perceived that Whatsapp based learning was fun besides improving their analytical skills. Our students also gave Whatsapp based SGL significantly higher scores on Likert scale compared to traditional classroom based SGL, atleast on two points.

In another study, conducted by Maske SS et al., on 1<sup>st</sup> year MBBS students, the feasibility, effectiveness, and students' attitude towards histology taught using Whatsapp was explored. Similar to our study, they also found that Whatsapp was effective, acceptable, and student friendly and like us they also recommended that Whatsapp should be used to complement traditional TLM [11].

In these days of smartphones, better and cheaper internet accessibility has led to an unprecedented surge in the use of social media applications and IMAs like Whatsapp. It is considered as one of the most popular IMAs used by everyone irrespective of their age, social, economic and educational background. Easy accessibility and free



of cost usage are the two most important contributing points for the popularity of Whatsapp.

Whatsapp has already been used by clinicians to share patients' conditions and reports, thus saves time in important decision makings and treatment. Studies conducted outside India have also explored and established the effectiveness, acceptability and feasibility of use of Whatsapp in medical education both in undergraduate and postgraduate medical education [15,16]. Till date, in India, there were not many studies which explored the role of Whatsapp in medical education. Literature review revealed that, ours was probably the first study comparing the traditional classroom based SGL and Whatsapp based SGL using a problem based TLM among undergraduate medical students.

The popularity of this messaging application was also seen among medical students. Hence, apart from the purpose of socialising Whatsapp can be used as TL platform, especially for PBL settings. In PBL settings, Whatsapp can be highly useful as it facilitates interactions among its users, sharing of relevant resource materials and finally providing access to those materials anytime and anywhere. Unlike traditional face to face classroom based interactive classes (SGLs), there is no time limit and students and teachers can interact with on another outside college/working hours and can share resource materials without the need of in person meetings. However, on the other hand, it has to be kept in mind that interactions outside the usual college hours can put extra work pressure on the teachers. Another benefit of Whatsapp over traditional classroom based SGL is that students can access the resource materials posted in the Whatsapp group anytime anywhere and as many times as they want.

Other than PBL, Whatsapp applicability is rather limited as it is not a good platform to introduce the students to a new topic. For the same purpose, DL would be best. However, after DLs, Whatsapp can be used as a platform for discussion on that particular topic. Again, without a PBL approach, Whatsapp based discussions or SGL sessions may lose focus and deviate from the learning objectives. So it would be prudent to start a Whatsapp based discussion session with a problem from the topic of choice.

From a teacher's perspective, retrievability of the Whatsapp chats on a specific topic not only helps in assessing students' participation and understanding of the topic in that particular discussion but also gives an indirect feedback regarding the DLs in which the students were first introduced to the topic. Based on the students' questions and ability to participate in the discussion fruitfully, the teacher might decide which particular parts of the topic require special mention in the DLs for the same topic in the next batches of students.

One interesting finding can be noted from our study is that, although students were informed beforehand that Whatsapp based SGL sessions are just like classroom based SGL sessions where they can discuss about their doubts pertaining to the specific topic being discussed on the day and the wrong answers posted in the group will not be a part of any type of assessment of the particular student, only few of the students of the two of the Whatsapp groups did actively participate in the group discussion.

The factors which might make a student hesitant to participate in Whatsapp based SGL can be, fear of making a silly mistake/comment in group chats which can be/would be saved, read or even shared among his or her classmates or with others. However, as there is no documentation of such mistakes/comments in classroom based SGL sessions, the students are probably less hesitant to take part in active discussion during classroom based SGL sessions. However, feedback from the students revealed that they prefer both classroom based SGL and Whatsapp based SGL together over either of them [Table/Fig-2b].

Also, regarding effectiveness as measured by the post-test scores there were no significant differences between the two groups, considering the students' preference, we recommended that for certain topics on Pharmacology for PBL besides classroom based SGL sessions, Whatsapp can also be utilised as TL platform.

However, the certain disadvantages of Whatsapp based teaching platform should also be kept in mind, like, without smartphone and internet connection this TL platform will not work. Also, it could become additional burden on the students besides usual academic activities as Whatsapp based TL is not time bound like classroom based TL. To ensure adequate student participation and effective interaction Whatsapp groups with smaller number students are preferable, which would require increased number of faculty members as facilitator, which might not always be feasible in all medical colleges.

### Limitation(s)

Major limitations of our study include small sample size (we have 100 second phase students, of which 91 fulfilled the inclusion criteria), assessment within a short period of time (hence could not evaluate the effect of Whatsapp based SGL on long term retention), and conducting the study only for one specific chapter of Pharmacology.

### CONCLUSION(S)

Although Whatsapp cannot fully replace classroom based SGL, in current times its utility and prospect in medical education should not be ignored. Thus, Whatsapp based SGL can be used in combination with classroom based SGL sessions for certain topics in Pharmacology, if not for all, for better understanding, increased interactiveness, and also to motivate students for SDL. However, more studies involving larger sample size and on different subjects (and different topics) should be carried out to fully understand and explore the pros and cons of Whatsapp as a TL tool in medical education.

In order to increase the sample size authors are planning to conduct similar study in collaboration with other medical colleges under the same university involving students from the same phase. Also, in continuation of our study, we would like to take another MCQ based exam for all the students after six months. In future authors would like to plan similar Whatsapp based SGL studies on other topics of Pharmacology.

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**PLAGIARISM CHECKING METHODS:** [\[Jain H et al.\]](#)

- Plagiarism X-checker: Jul 07, 2021
- Manual Googling: Sep 17, 2021
- iThenticate Software: Sep 15, 2021 (5%)

**ETYMOLOGY:** Author Origin**AUTHOR DECLARATION:**

- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. No

Date of Submission: **Jul 06, 2021**Date of Peer Review: **Jul 29, 2021**Date of Acceptance: **Sep 18, 2021**Date of Publishing: **Oct 01, 2021**