Introduction of case-based learning aided by WhatsApp messenger in pathology teaching for medical students

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ABSTRACT

Aims: The present study was carried out for comparative evaluation of case-based learning (CBL) aided with WhatsApp and didactic lectures (DL) while teaching a pathology topic to second-year medical students. In addition, the acceptability of WhatsApp as an aid to CBL was assessed. Material and Methods: After obtaining informed consent, 70 second-year Bachelor of Medicine and Bachelor of Surgery (MBBS) students were exposed to six sessions of CBL aided by case scenarios for one set of topics of anemia posted on WhatsApp groups. This was followed by six sessions of DL for separate set of topics in anemia. The multiple-choice questions (MCQ) test scores obtained pre and postintervention, of CBL and DL sessions, were compared to paired t-test (within the groups) and Student’s t-test (between the groups). Categorical data were analyzed using Chi-square (χ²) test. Student’s self-administered questionnaires and focus group discussions (FGDs) were used to collect student perceptions and analyzed quantitatively, as well as qualitatively. Results: The mean MCQ scores obtained postintervention in CBL topics were significantly higher compared to DL (22.78 ± 2.99 vs 17.78 ± 3.35; P < 0.001). Students perceived that CBL enhanced their curiosity; hence, the acquired knowledge through various resources was retained better. It enhanced their analytical skills and interest in learning pathology. In FGDs, the students appreciated the use of WhatsApp as an aid to CBL for its ease of sharing scenario-related additional information and prior discussions among themselves in chat groups at their convenience. Conclusion: CBL aided by WhatsApp helped students acquire knowledge, discuss and learn actively, score more, and retain better than DL. Using WhatsApp as a platform helped them to interact at their ease and seek guidance from their mentors without resistance and hesitation.

KEY WORDS: Focus group discussion, self-directed learning, small group discussion, smartphone application, social networking

Introduction

Innovative methods of interactive learning have replaced didactic teaching (DT) in many medical universities worldwide in last three decades. Case-based learning (CBL) is one such student-centered interactive teaching-learning (TL) method, which incorporates many traits derived from problem-based learning (PBL). Students are provided with a previously designed case in which background clinical history of patient with additional information, such as examination findings, vital signs, symptoms, and laboratory results are provided. Students are expected to approach clinical cases in a problem-solving manner, understand etiopathogenesis of disease, interpret laboratory reports, establish a practical approach to laboratory diagnoses of disease, confirm clinical diagnosis, and plan patient management according to laboratory results in a clinical context. Discussing cases in a small group...
enhances peer learning. Regular time-to-time feedback from peers, facilitators, and faculty strengthens this learning further.\(^2\)

WhatsApp has become the most accepted and conveniently used social networking smartphone application.\(^3\) Its use as a social media platform has increased tremendously since its launch in 2009 with an estimated increase in around 400 million active users each month.\(^4\) The convenience of creating chat groups with large number of members, broadcast groups, exchanging media files, and sharing two-way information in fraction of minutes has made it an ideal smartphone social media app.

CBL has not been made mandatory by regulatory bodies in medical education in India so far so it is not been in practice in teaching basic and clinical sciences. Although there have been few individual studies on CBL and WhatsApp,\(^5\) very few researchers have tried to evaluate WhatsApp as an aid to CBL. The studies conducted in pathology were either on postgraduate teaching,\(^6\) or were conducted for a very short duration for one or two topics or cases.\(^7\) We conducted this experimental pilot study to evaluate the efficacy of CBL, compared to didactic lectures (DL), and evaluate the acceptability of WhatsApp as an aid to CBL in the undergraduate pathology TL process. Student perceptions obtained through questionnaires and focus group discussions (FGDs) were quantitatively and qualitatively analyzed.

### Material and Methods

This interventional pilot study was conducted in a North Indian private medical college, wherein faculty members are trained in basic and advanced medical education courses of the Medical Council of India (MCI) and students use Android phones. This TL program was carried out for students of second professional Bachelor of Medicine and Bachelor of Surgery (MBBS) batch in the subject of pathology in four phases:

a. Preparation phase
b. Pre-intervention priming phase
c. Intervention phase
d. Post-intervention assessment phase, data acquisition, and statistical analysis.

#### Preparation phase

A TL module was designed in consultation with faculty members of the department of pathology. It comprised of six sessions of CBL followed by six sessions of DL taught to MBBS students of the second professional batch. The topics included in CBL sessions were basics of anemia, iron deficiency anemia, differential diagnosis of iron deficiency anemia, megaloblastic anemia, thalassemia, and sickle cell anemia while the topics covered through DL were hereditary spherocytosis, autoimmune hemolytic anemia, G6PD deficiency anemia, paroxysmal nocturnal hemoglobinuria, microangiopathic hemolytic anemia and fragmentation syndromes, and pancytopenia. The topics with variable difficulty levels were distributed equally between the two methods of TL. Content and face validation of all parts of this module (including sequence of sessions, cases, investigations, slide images, MCQ questions, short answer questions [SAQ] questions, survey questionnaires, and guiding points of FGDs with participants) was done by eight faculty members of the department in an FGD. Five second-year residents were recruited for the facilitation of CBL sessions in this study. They were trained for conduction of CBL-based intervention and teaching before commencement of priming phase. The approval for this study was obtained from the institutional ethics committee. (IEC No- 2017/227, dated-05/04/2107).

#### Pre-intervention priming phase

All second-year professional MBBS students (n = 78), in an introductory session, were given information regarding the present study and written voluntary informed consent was obtained from them. Seventy of them agreed to participate. Students were divided into 10 groups of 7 students each by random allotment using lottery method by allowing them to pick up numbered slips. Ten different WhatsApp groups were created. One resident doctor was made a group administrator of two groups and the investigating teaching faculty member responsible for coordination of the study was added to all the groups. One MCQ-based pretest (70 marks) was conducted pre-intervention. The test consisted of 70 single best response MCQs from CBL and DL topics (35 each). In these 35 MCQs, one-liner MCQs (22 each) and case history-based MCQs (13 each) were included. The ratio of easy, intermediate, and tough questions was similar for both types of topics.

#### Intervention phase

Two sessions were conducted per week over 3 weeks followed by six DL with similar frequency. One week before each CBL session, predesigned clinical cases comprising of the patient’s clinical history and examination findings, including symptoms and signs and relevant blood investigation reports, were posted on all the WhatsApp groups. All the 10 student groups got the same case related to one topic of anemia at one time. They were given freedom to read, search various resources for acquiring information, and discuss the cases among themselves out of the classroom at their convenience, and their mentor resident doctors kept a watch to avoid discussions going haywire. Students were expected to approach clinical cases in a problem-solving manner, establishing a practical approach to laboratory diagnoses of disease, and create a differential diagnosis. The faculty member kept checking the discussions in between and guided resident doctors, if necessary. Peripheral smear, bone marrow aspiration, and biopsy images were posted for students one day before the discussion in the contact session. On the day of direct contact session, students were given 15 min to prepare the final presentation under the supervision of the resident mentors. The role of the mentor was to keep the students focused on learning objectives and ensure group dynamics in the classroom session. Students from each group, who presented different aspects of the case, including interpretation of clinical history, examination findings, investigation approach, and the interpretation of investigations in context of the case to the rest of the class, were chosen. The faculty member provided guidance whenever necessary during their presentation. All the relevant points were summed up by the faculty member at the end with corrections in the students’
presentation. The next six sessions were in the form of DL on other anemia topics of similar difficulty level by the same faculty.

Postintervention assessment phase, data acquisition, and statistical analysis

One MCQ-based post-test was conducted one day after the last session of DL for the students present on that day in which the same questions as given in the preintervention phase were projected on the screen to assess the gain in knowledge after the intervention. Two weeks after the completion of entire DL sessions, another post-test was conducted to evaluate retention of knowledge. This test included six SAQs each from topics taught by CBL and DL methods.

At the end of the entire course, students’ perception was obtained through two surveys using group survey technique. In utility survey, feedback was obtained regarding the utility of CBL and DL as TL methods on two separate feedback forms. Feedback for entire course was obtained through course evaluation survey. These Likert scale questionnaires were predesigned and validated. Collected questionnaires were deidentified to maintain anonymity during data analysis.

FGDs were also conducted on the basis of an interview guide. One resident interviewed two groups simultaneously as there were five residents involved and 10 groups for FGDs. The questions pertaining to the organization of the sessions and process of TL, acceptability of the methods, learning the pathology subject, and other perceived benefits were included in FGDs. Student responses were electronically recorded on mobile devices. The resident mentor also noted important points of discussion and summed up the findings to each group at the end of discussion. The audio recordings were also posted on the WhatsApp groups for the students’ approval. The FGD recordings were heard and transcripts were read by all the investigators individually and valid inferences were jotted down for all the statements. The points going in favor of and against the intervention were noted down. The analysis was done using thematic analysis.

Statistical analysis

Data were described in terms of mean ± standard deviation (SD), frequencies (number of cases), and relative frequencies (percentages), as appropriate. Comparison of quantitative variables between the study groups was done using Student’s t-test and Mann–Whitney U test for independent samples for parametric and nonparametric data respectively. For comparison of scores of pre and postintervention MCQ tests within the groups, a paired t-test was used. For comparing categorical data, Chi-square ($\chi^2$) test was performed and the exact test was used when the expected frequency was less than five. A probability value ($P$ value) less than 0.05 was considered statistically significant. All statistical calculations were done using the Statistical Package for the Social Science (SPSS) version 21 statistical program for Microsoft Windows.

The intervention would be considered effective if:
1. The pretest–posttest score showed a statistically significant difference at 95% confidence interval (CI)
2. The CBL and DL post-test scores showed a statistically significant difference at 95% CI
3. At least 50% of the students report WhatsApp as a satisfactory aid for TL.

Results

As shown in Table 1, out of the 66 students who returned back the course evaluation survey, most of the parameters were scored ≥4 on the Likert scale by more than 50% of the students. Data of 54 students were available in the post-test and were compared to their pretest. As shown in Table 2, on comparing the mean MCQ-based post-test scores obtained by students in CBL and DL topics, we found significantly higher scores (22.78 ± 2.99) in CBL topics compared to the DL topics (17.78 ± 3.35), with a statistical difference of 5 ± 3.59 ($P < 0.001$). The gain in mean scores in post-test from pretest was 17.019 ± 2.202 in CBL topics compared to 13.611 ± 2.595 in DL topics ($P < 0.001$). In case history based questions ($n = 13$) from topics taught by CBL, out of 54 students 52 students (96.3%) could score ≥50%
questions correctly and 14 students (25.9%) could score 10 questions correctly. As against this in topics taught by DL, out of 34 students only 26 (76.5%) students could score ≥50% case history based questions correctly and only 1 student (2.93%) could score ≥10 out of 15 questions correctly. In late post-test, 59/70 students scored more than 60% in topics taught by CBL as compared to only 48/70 students scoring more than 60% in DL topics. On comparing Likert scale scores given by students to different parameters in utility survey by the Mann–Whitney U test for independent samples [Table 3], the mean rating of most of the parameters like improvement of analytical skills, motivation for (self-directed learning) SDL, help in long-term retention of topic, enhanced ability to retrieve information, ability to cooperate among students, and clinical oriented learning was more than 3.7 for CBL, while it was less than 3.15 for the same parameters for DL sessions (Z < 0.001). As the statement that the knowledge learned through the sessions was fragmentary and useless and the sessions increased my academic burden to some extent were negative statements; hence, they were reverse scored and analyzed. Only 15/66 considered CBL as an academic burden while 28/66 disagreed with this and 23/66 were neutral to it. The responses to DL were similar. Only 7 students considered it as an academic burden, 33 disagreed with it, and 26 were neutral to it.

When comparing the number of students giving highest Likert scale scores to various parameters in the utility survey, pertaining to CBL versus DL sessions (Chi-square test), it was seen that students felt that the CBL sessions were more likely to improve their analytical skills (χ² = 24.193 and P = 0.019); SDL (χ² = 34.443 and P = 0.005); performance in MCQs (χ² = 31.45 and P = 0.012) and long-term retention (χ² = 45.01 and P ≤ 0.001); ability to retrieve information (χ² = 27.782 and P = 0.006); clinical oriented learning (χ² = 15.727 and P = 0.204); and ability to cooperate with students (χ² = 22.103 and P = 0.036) than the DL sessions, and it may help them in community practice (χ² = 17.15 and P = 0.376).

Few of the points favoring and against CBL aided by WhatsApp, which emerged in FGDs, are highlighted in Table 4. In FGDs, more than 60% of the students admitted generating interest in pathology after the introduction of CBL and almost all students admitted that cases posted through the WhatsApp messenger gave them freedom to discuss with their group mates, share views, increase understanding of topics, and helped create a wholesome picture. However, 70/70 students had to depend on other students because of either unavailability of smartphone or phone hardware or software damage. In addition, 15/70 students admitted facing Internet data connectivity issues during downloading of cases and during discussions. But, beyond these limitations students still advocated that CBL promoted cooperation and their random distribution in groups enhanced their interpersonal communication (67%) without hindering group functioning. However, for better discussion, they asked for a smaller group size of four to five members instead of seven. Students experienced that occasionally too many people discussing on WhatsApp distracted them from the main topic. Students admitted that CBL enhanced their analytical skills (72.7%) and helped in clinically oriented learning (67%). However, it was suggested that examining patients directly inward would be a much better way to learn.

### Discussion

The Institute for International Medical Education (IIME) has grouped a set of minimum learning outcomes that medical
students should demonstrate at the time of graduation under seven broad educational domains. Of these, critical approach, research-oriented attitude, problem-solving skills, and communication skills deserve special mention. Keeping this in mind, we introduced CBL as a method of student-centered and structured learning.

We assessed the efficacy of the intervention by gain in knowledge through pretest–post-test design. The difference of mean pretest–posttest scores highlighted the significant improvement in knowledge in both CBL and DL, proving both as effective TL methods. But, the overall knowledge gain was more in CBL compared to DL as significantly higher post-test scores were observed in CBL topics than DL topics. Mohankrishnan et al. opined that this is likely because introducing the topic in advance increases the attentiveness in session and eagerness to learn. In our study, post-test assessment scores of most of the students were more in CBL topics than DL topics. But, on evaluating the student feedback for the same in surveys, P value was found insignificant because students’ feedback varied as per their expectations about performance in post-test in CBL or DL topics. Authors have reported similar feedback in previous studies on comparison of CBL vs DL in subjects like microbiology, biochemistry and clinical subjects. In their studies students perceived CBL to have improved communication, coordination, and cooperation with fellow students, besides enhancing clinically oriented learning, analytical and reasoning skills, in-depth knowledge and long-term retention.

In the present study, more than 50% of the students felt more interested in studying pathology with the introduction of CBL. Our students admitted in the feedback that CBL stimulated SDL (62.1%). They admitted having studied books, discussed in assigned groups, and used resources on the Internet like Google, Wikipedia, YouTube video demonstrations, and more on their own to understand the cases. Thus, CBL encouraged students for open-ended exploration of issues and encouraged discussion. The study group students are primed; hence, they are motivated, more attentive, and highly participating during the discussions and study sessions. Similar to our study, in a study by Mohankrishnan et al., majority of the participants also found challenging clinical cases as a strong motivation to identify gaps in their knowledge, honed their thinking skills and creativity, and were encouraged for self-directed literature search. However, in a study by Sudhakar et al., students wanted DL to be followed by tutorial and later CBL, while Shetty et al. recommended that both DL and CBL should be used in succession for better understanding of the subject matter.

Our study participants perceived WhatsApp as a good platform for sharing CBL cases as it was already popular among them for personal communication. It gave them an opportunity to view case history and investigations at their convenience beyond class hours and even at later date; discuss among themselves, share Internet-based information, links, and e-book pages; and even seek guidance from their mentors, thus, flattening the hierarchy. In addition, in studies by Garg and Singh and Shetty et al., the students appreciated the interaction and loss of resistance with teachers, staff members, and other faculty. Simultaneously, smartphone-based Internet searches allowed them to understand the interpretation of investigations and their normal ranges. We preferred this app for our study because of the possibility of creation of broadcast and chat groups with more than 100 members; uploading and distributing cases to all groups or particular groups at one time; posting pathology slide images unaltered, which were captured through an Android phone’s high-quality camera, patient videos; and even audio recordings of FGDs. However, this should be done with great care and discretion so as to maintain privacy, confidentiality, and professional standards. One great advantage was ease of evaluating student participation rates because of record of communication; hence, the faculty did not need to be on toes to be actively observing entire the discussion. Above all, no extra cost was incurred or training of faculty, residents, or students was required to use this as a study platform. Raiman et al. also shared similar views. The disadvantages were unavailability of smartphones with two participants, Internet data connectivity issues, and software and hardware issues, leading to the loss

Table 4: Few statements given by students in FGDs in favor of and against CBL

| Points in favor of CBL                                                                 | Points against CBL                                                                 |
|---------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| “Cases made us do self-directed learning, search resources on our own, search books, Internet, read and discuss.” | “Photos and videos of patient showing symptoms and signs were a good exercise. However simulators would have worked well.” |
| “Those topics where cases were allotted and discussed in groups are better retained and understood as compared to those which were without case discussions.” | “The case allotment was sometimes an extra burden when we had assignments from other departments too. I would have retained knowledge better without CBL” |
| “Group discussions need to be coordinated and directed by the faculty or resident mentors.” | “It’s better to show signs and symptoms on a patient directly along with the case discussion.” |
| “Allotment of only one case to a group in a week gave us adequate time to study the case on our own. Getting cases too frequently is cumbersome.” | “Group partners didn’t matter till we had good communication between us. Dividing students randomly in groups helped us to increase our interpersonal communication.” |
| “Rather than a surprise exam we should have been given time for MCQ preparation. But overall it was good for assessing our involvement in class discussions. Projection on screen was good to give equal time to all.” | “Those topics where cases were allotted and discussed in groups are better retained and understood as compared to those which were without case discussions.” |

FGD: Focus group discussions, CBL: Case-based learning, MCQ: Multiple-choice questions
of data experienced by two students. Active involvement of mentors and WhatsApp group administrators was required to keep the discussion focused and avoid any deviations toward useless chitchat. However, it was not so difficult in our study because of restriction of group size to seven members each.

In a few similar studies, learners admitted lack of interest because of difficulty in involvement in all discussions, being shy of discussing in group, not being motivated enough for SDL, or facing Internet connectivity issues.[1,5,15–17] The authors recommended provision of digital libraries and free WiFi to overcome this issue.[1] Goyal et al. opined that the use of smartphones for discussions can be time-consuming, addictive, and may interfere with daily professional and personal responsibilities; hence, it needs regulation. [6] Similarly, Maske et al. and Lohitashwa et al. faced discomfort because of unimportant and irrelevant message flooding and off-topic communication because of large group size.[17,18] However, our participants judiciously used the app with proper time management because of supervision by mentors and even addition of teaching faculty to all the groups. Raiman et al., as teachers, found the lack of body language and direct eye contact a big deterrent to active teaching.[7]

In our study, 18/70 students complained of time constraints because of assignments from DT activities of other departments; hence, their participation in group discussions and self-study efforts were halfhearted. Such methods require students to take responsibility for their own learning, but active efforts, and take out adequate time for SDL. Ekram et al. stated that the contrasting and conflicting curricular and time demands of didactic teacher-directed learning diminishes the value of problem-based learning. Out of the 70 students, tutorial teaching, teaching inwards, DT, and university exam-based teaching were recommended by approximately 10% of the students. So, we can infer that many students just feel the necessity to consolidate learning for obtaining better performance in the assessment process. Hence, similar to the opinion of Valero et al., we also felt that though all students consented for a student-centered active learning method like CBL, few were still tied to concepts of traditional teaching and had summative assessments as the main motivator for knowledge acquisition.[19]

Limitations of the study
This study was conducted for a small cohort of students (70 students) for a short duration and teaching only one topic of pathology. Thus, the results have limited generalizability for other pathology topics or medical subjects.

Conclusion
Hence, our study highlights that CBL aided by WhatsApp helped students to learn actively through self-directed efforts, retain the learning, and apply it. Students perceived WhatsApp as an acceptable platform in supplementing CBL as the TL method.

We recommend more such studies for larger cohorts of students and spanning over more topics of one subject or an entire subject or even entire curriculum to investigate the utility, acceptability, and efficacy of WhatsApp messenger as a platform for methods of active learning like CBL.

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Conflicts of interest
There are no conflicts of interest.

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