

Original Research Article

Evaluation of hybrid problem-based learning in large classrooms: a qualitative and quantitative analysis

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ABSTRACT

Background: Problem Based Learning (PBL) for teaching preclinical sciences has been proposed in curricular reform by Medical Council of India. PBL is a student-centred approach, enabling deep and transformative student learning. A 'hybrid' approach to PBL uses a range of class-based teaching methods; delivering a mode of PBL which is less resource intensive and more flexible than 'pure' PBL. In hybrid PBL, problems are solved in groups, but lectures are used to present the fundamental concepts and difficult topics. Our institution follows a traditional lecture-based curriculum. The present cohort study was undertaken to determine student and faculty perceptions for hybrid PBL as well as impact on student engagement.

Methods: Hybrid PBL method was implemented for one cohort of hundred first year medical students. Previous batch was used as control taught by traditional lecture-based curriculum alone. Methodological triangulation design was employed for impact of hybrid PBL on student engagement (attendance scores-Chi square) and student and faculty perception to hybrid PBL (reflections- grounded theory)

Results: The mean attendance score of MBBS batch 2016 was significantly better than batch 2015 ($p=0.0001$). The emerging themes in student reflections were innovative method, collaborative learning, quest for knowledge, promote long term retention and links to real-life scenario. Acquisition of soft skills (social and moral responsibility) was novel emerging theme in student reflections. Active student participation and improved critical thinking were themes expressed in faculty perceptions.

Conclusions: Hybrid PBL with small groups is successful in large classrooms. Introduced at the initial phase of undergraduate medical education, it can assist robust self-appraisal in students and strengthen soft skills.

Keywords: Student engagement, Student reflections, Soft skills, Undergraduate

INTRODUCTION

There has been a significant increase in the number of seats for students in Indian medical schools to combat the perceived shortage of doctors.¹ At the same time, intake of teaching staff has not been increased proportionately. Even the norms for the stipulated minimum student-teacher ratio for medical colleges have been relaxed by the Medical Council of India (MCI). It now varies

between 6.6:1 (Community Medicine), 7.1:1 (Medicine/Surgery) to 25:1 (Forensic Medicine) for 100 admissions. The student teacher ratio in Anatomy is minimum 12.5:1 as per the MCI guidelines. MCI stipulates for Anatomy, 4 tutors, 2 Assistant Professors, 1 Associate Professor and 1 Professor as minimum requirement for 100 students.² Therefore, medical colleges in India usually follow a traditional lecture based curriculum.³ This Institute also follows a traditional lecture based curriculum. However,

traditional lecture based learning (LBL) leads to passive learning and low motivation in students.⁴ Various strategies to enhance student learning and course engagement in medical curricula have been proposed. These include problem based learning, case-based learning, integrated teaching and patient-oriented problem solving.⁵⁻⁸

Problem-based learning (PBL) is a collaborative and participatory student centred approach. Models of PBL vary considerably. In a full PBL, the problems guide and drive the entire learning experience; in this form there are no lectures from the 'expert' and groups or individuals work independently of one another.⁹ Implementing full or "pure" small group PBL is not possible in large class rooms with scarce faculty numbers, motivation and training. A 'hybrid' approach to PBL uses a range of class-based teaching methods and blended learning techniques; delivering a mode of PBL which is less resource intensive and more flexible than traditional PBL. In its problems are solved in groups, but lectures are used to present the fundamental concepts and some of the more difficult topics.⁵ Hybrid-PBL is incorporation of case/PBL discussion method along with the traditional lecture-based method.¹⁰ Thus, in our Institute, innovative delivery of hybrid PBL with small group sessions was envisaged.

Previously reported implementation of PBL in Indian Medical Schools relies solely on quantitative measures of outcome evaluation.¹¹⁻¹³ Problem Based Learning (PBL) for teaching preclinical sciences has been proposed in recent curricular reform by Medical Council of India in Regulations on Graduate Medical Education, 1997 (Amended up to July 2017, page 5: sub clause 15).² The recent revised curriculum proposed by MCI proposes credit system for students for participation in PBL.¹⁴ Thus exploratory studies for faculty and student perceptions would add data to pave the way towards implementation of proposed curricular reforms. The aim of this study was evaluation of hybrid PBL, using both qualitative data analysis of student and faculty reflections in addition to quantitative comparison of attendance.

Aim of study was to assess "What was actually delivered?" the following research questions were considered:

- What are the perceptions of students and faculty for hybrid PBL led by a single tutor?
- Does hybrid PBL impact student engagement?.

METHODS

The present investigation included two consecutive batches of the 1st year MBBS students (all students in each batch). Three independent faculty members also participated. Informed written voluntary consent was taken from the participants. All research was carried out in compliance with the Helsinki declaration.

Traditional lecture based curriculum was followed for the batches (2015 and 2016) including lecture demonstrations, small group teaching, small group laboratory work and use of audio-visual aids. Both batches were taught by the same set of eight teachers following the same teaching schedule for lectures, lecture-demonstrations and dissection discussion.

In batch 2016, hybrid PBL was implemented along with traditional curriculum stated above. Four cases (three sessions per case scenario) were planned and implemented. Two cases for upper limb (breast cancer and fall on outstretched hand) were implemented. Two cases were conducted during lower limb region (inguinal hernia and sciatica). The intervention followed a previously described method in literature.¹⁵

Each case was implemented in three sessions, one week apart, (1hr; 1hr; 2hrs) during dissection hall time. In all sessions, the students were divided into ten groups and instructed to choose a scribe, time keeper, leader and reporter from the group. (A lecture on the topic e.g., pectoral region, had been taken two days before the first session). All students were provided paper case (e.g. breast cancer case-scenario: Annexure 1). The students formulated learning objectives after consulting the course text book through group discussion. Then the learning objectives were presented in the larger group by the reporter of each group. The hybrid PBL facilitator wrote all the learning objectives on white board simultaneously during large group presentation. Subsequently, students were provided additional learning tasks which involved synthesis of knowledge. In the third session, students reached a conclusion for the case along with a consensus for further learning task. The dissection of concerned region and associated lectures were conducted in a standard manner during their scheduled time.

Data collection and analysis

We employed methodological triangulation design in this study using both qualitative and quantitative measures. Qualitative data consisted of student and faculty reflections. Ninety-five (95/100) students reflected on their learning at the end of the term and submitted anonymous written reflections. Three independent faculty members also reflected on the process. All reflections were typed post collection and numbered randomly by a steno-typist (student reflections 1 to 95 and faculty reflections F1, F2 and F3). The reflections were coded and categorized for emerging themes using principles of Grounded Theory. XY conducted thematic analysis using editing style to identify key themes and cluster data within them. The themes were compared to the reflections by reading and re-reading them by XY and AB (to ensure a good fit). All the authors reviewed the written report for internal consistency of the process. Quantitative data consisted of end-of-term attendance. The statistical analysis was done using Chi-square test.

RESULTS

Qualitative analysis

Emerging themes from student reflections are collaborative learning, soft skill acquisition, innovative

method, long-term retention of knowledge, quest for knowledge and link to real life scenario (Table 1).

Participant statements are highlighted in indented paragraphs and italicized words. Long quotes are provided in Table 1, organized by major themes.

Table 1: Themes in student reflections^a (n=95).

Themes	Student reaction
Reactions	I really liked it. It was a new experience. Wearing white coat doesn't make me happy but when I apply clinically in routine life, makes me feel good and feels like a doctor. It was a novelty being treated with respect and feeling that our opinions mattered was a very precious one.
Involves collaborative learning	As it was a teamwork, mixture of every one's knowledge lead to a better result which wouldn't have been possible individually. Everybody had some theories about the case, in the beginning it was confusing one but as it progressed; we were able to narrow it down to a conclusion. Discussing with peers is easier as we don't have to worry about being wrong.
Promotes soft skill acquisition	The discussion made me more aware of the disease and also my responsibility as a doctor. As we are in 1 st year of MBBS now, people love to discuss their daily life problems with us and also expect some valuable suggestions from our side. Such activities help us to make people or at least our neighbours aware of various problems that can be prevented. I belong to a rural area; people are not so educated there so I love to tell them new things that I have been taught here by you. We also learned more....which has made me more aware of my future role as a practicing doctor in our country regarding the economic and social situations of my patients.
Innovative learning method	Innovative method of learning. Interactive way of learning. In routine teaching, I sometimes don't understand the point of learning it. But in these sessions I do. It was an active learning process as we ourselves had to eliminate and diagnose the problem based on hints provided.
Helps long-term retention	Helps in remembering almost 90% of facts in a single reading and even remembering it for longer periods of time. On daily reading we don't pay much attention to clinical of any topic but this helped to memorize it well. This way is ultimate step to retain the topic for longer period of time.
Quest for knowledge	Through this, I was able to go through even some minute things about the topic that I wouldn't have paid much attention on while normal reading. We Googled about it also. This way we at least read the topic ourselves at home without any sub stage.and best of all made us read different books on the topic. I scrolled pages of book, many concepts were cleared. The discussion helped me freely ask queries that sometimes I am afraid to ask in class. This case forced me to search the web for stuff that wasn't in the book. (Perhaps it was something not for I st Prof, so I was not bounded by the limits of I st year.) It was my own thirst for knowledge.
Links to real life scenario	Gave us chance for practical application in real life scenario. Taught us steps to examine, diagnose and treat patients..showed us a glimpse of future. Helps us to expand our horizons and actually make us feel like a doctor.

a-The reflections were coded and categorized using principles of Grounded Theory. Student quotes are presented verbatim as sentences

Quantitative analysis

The engagement of students of MBBS batch 2016 with hybrid PBL introduced as adjunct to traditional curriculum was compared with similar cohort of students of MBBS batch 2015 taught by traditional curriculum. Term-end attendance of both batches, in hours, was compared. In the Table 2, it can be seen that the total number of hours is similar. Chi-square test used for

statistical analysis of attendance scores of two cohorts (Table 2) showed highly significant statistical difference for the attendance scores for the hybrid PBL cohort. Thus, the batch 2016 absenteeism was significantly less than that of batch 2015 which acted as control. Thus, it can be inferred that sessions of hybrid PBL resulted in increased engagement of the students, all other factors being same for both the batches.

Table 2: Inter comparison of attendance of cohorts. (n=100).

Batch	Present (hours = %)	Absent (hours = %)	Total (hours =100%)	p value (Chi-square test)
Control	22011 (85.4%)	3749 (14.6%)	25760	$\chi^2=729.7, p <0.0001^*$
Hybrid PBL	23070 (89.8%)	2611 (10.2%)	25681	

*Statistically significant

DISCUSSION

Single tutor facilitated the hybrid PBL sessions for hundred undergraduate students, divided in small groups of ten students each. To assist tutor, students were encouraged to seek help from textbook in all sessions. Interaction of students with content in an engaging manner was facilitated by allowing use of smart phones (internet) during sessions. Teams followed group dynamics which also led to more organized discussions in groups.

Ninety-five students report hybrid PBL as a novel experience. They found it engaging and felt that it promoted collaboration and learning. Case 1 was liked most. Surprisingly, the reported acceptance (91/95=95.7%, 90/95=94.7% and 85/95=89.4 %) of cases 1, 3 and 4 is much more than case 2 (45/95=47.3%). The probable explanation lies in similarity of design of delivery of case 1, 3 and 4. The common features in these were paper-based case sheet provided individually, small group activity, formation of learning objectives by students themselves and time for peer interaction. On the other hand, in case 2 scenario and learning objectives were projected on power-point slides. This is corroborated in another study, where dental students expressed that formulating learning objectives themselves, motivated them to learn the new topic in PBL by developing self-directed learning skills.¹⁶

The emerging themes in student reflections are similar to other published studies.^{17,18} Team based learning, collaboration, innovative learning method, quest for knowledge, long term retention have been reported earlier. Social accountability is a novel soft skill that emerged in student reflections.

“We also learned more.....which has made me more aware of my future role as a practicing doctor in our country regarding the economic and social situations of my patients.”

Exploration of content triggered by student inquiry, spurred the students towards detailed knowledge acquisition. As the learning was internally motivated, retention of knowledge for long term was reported (Table 1). Its propelled quest for learning:

“.....discussions on clinical cases, was the first time I opened my Anatomy textbook. Because there was a real urge to study and add up to points to the team, which others were missing.”

They felt that it gave them “a glimpse of the future”. It forced them to self-appraise their own competence for their future role. It made them feel accountable and responsible for their capability and knowledge.

“The discussions made me more aware of the disease and also my responsibility as a doctor.”

Three independent faculty members reflected that they found the students actively participating, demonstrating active critical thinking. In addition, as the sessions progressed, students exhibited skills in using available information to generate causal relationships and valid hypotheses even in routine teaching sessions. They expressed that this was a pleasant difference from previously taught batches of students.

The quantitative analysis showed significant differences in inter-comparison of attendance of the batches. The attendance score consisted of the cumulative term end attendance of individual students of the batches (Table 2). This demonstrates that hybrid PBL promotes student engagement. This results for improved student engagement are similar to other published studies.^{3,4,7,11-13}

CONCLUSION

Facilitators, planning innovative teaching in large classrooms must be aware of the various strategies to make the implementation fruitful. This study provides evidence that hybrid PBL with small groups can be successful in large class-rooms for preclinical subjects. The results show that this can help improve content retention as well as soft skills in novice learners. Introduced at the initial phase of undergraduate medical education, it can be the answer to strengthen soft skills and social accountability in students.

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ANNEXURE 1

Hybrid PBL Case 1 (Breast cancer case scenario)	
Session 1	A 32 years old, married female presents in the OPD with a painless lump in left breast. It has been noticed since 3 months, but was ignored initially. There is no history of any redness or pain in the lump previously. There is no history of any discharge from the nipple in either breast. The patient also complains of bony pains in the cervical and thoracic regions. Further inquiry reveals history of 6 kg weight loss (unexplained), in the last 3 months. She has been married for 3 years and has no child yet.
Session 2	On examination, the lump is present in the upper outer quadrant of the left breast. The skin over the lump is normal in colour but shows “puckering” or orange-peel appearance. The nipple and areola are normal on left side. On palpation, the lump is non-tender. It is non-mobile, adherent to underlying tissues. Three groups of left axillary lymph nodes- anterior, lateral and apical are enlarged. The left supraclavicular lymph node is enlarged. The right breast is normal.
Session 3	On mammography, the architecture of left breast tissue is altered and non-uniform. A radio-opaque mass is also visible. Fine needle aspiration biopsy: shows presence of cancer cells. On computed tomography scan, the bodies of vertebrae show lytic lesions in all cervical and upper thoracic regions. Treatment: Tumour was inoperable. Medical treatment was started. The patient expired after 3 months of diagnosis.