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Perception of medical students and tutors on face-to-face vs. synchronous online problem-based learning in basic sciences of undergraduate program

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Abstract

Introduction: Problem Based Learning (PBL) is the major curriculum delivery system in our academy. Due to COVID-19, the face-to-face sessions were converted into synchronous online version. Thus, the objective of this study was to compare perception on face-to-face and synchronous online PBL of MBBS first- and second-year students in basic sciences and PBL tutors.

Method: This is a descriptive, cross-sectional study. A validated questionnaire was sent to the participants using google form. Quantitative data were entered as numbers and percentage and for qualitative data, thematic analysis was done.

Result: Students from first (n=48) and second year (n=55) and their tutors (n=10) were involved in this study. Majority of the participants were satisfied with synchronous online PBL, while half of them agreed this could be alternative to face-to-face PBL. The benefits were exposure to newer technology enabling easier participation, flexibility, and useful in adverse situation. However, students agreed or strongly agreed that the group dynamic 71(68.9%), critical thinking 62(51.2%) and team spirit 72(69.9%) were unsatisfactory. Tutors 6(60%) also had difficulty in assessing students in different aspects of PBL. Participants suggested that solving technical issues, timely feedback from tutors and self-motivation among students could help in smooth conduction of PBL.

Conclusion: This study showed that synchronous online PBL can be better alternative when it is not possible to conduct face-to-face PBL. Despite its limitation, particularly in achieving soft skills of PBL like teamwork and critical thinking, participants have suggested that technical support, timely training and self-motivation can overcome these.

Keywords: medical students; perception; problem-based learning; synchronous online learning; tutors

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Introduction

Problem Based Learning (PBL) is one of the widely used teaching learning methodologies in medical schools.[1] This method of learning engages students more in their studies in comparison to traditional method. PBL is not just solving the problem, rather it motivates students to obtain more information in order to approach the problem, critically analyze it and learn more through interaction, making a positive impact in their overall learning process.[2,3,4]

At Patan Academy of Health Sciences (PAHS), Nepal, PBL is the major teaching methodology in basic science years of undergraduate medical course, which was started in 2010. Because of COVID-19 pandemic, face-to-face PBL was converted into synchronous online PBL. This method of synchronous online PBL has been proven as effective as face-to-face PBL.[5] However, many aspects of virtual environments need to be considered for successful implementation like technical support, proper training and appropriate learning materials.[6]

Although, the effectiveness of online PBL has been proven, it's application in our context, more so in medical curriculum is still rare which could be due to lack of understanding on its effectiveness. In this study, to understand the effectiveness of online PBL, we compared the perception of online PBL and face-to-face PBL of undergraduate medical students and tutors facilitating online PBL sessions in basic sciences aiming to know its strength and limitations. The finding will provide insights to further develop and use the online platforms for PBL and other small group online teaching.

Method

This was a descriptive, cross-sectional study conducted at Patan Academy of Health Sciences (PAHS), Lagankhel, Lalitpur, Nepal. All the first and the second year MBBS students of PAHS and PBL tutors were included in this study.

For the purpose of this study, "Synchronous online PBL" referred to the PBL sessions that were conducted in real time using online Zoom platform i.e., both students and tutors were present online at same time to run PBL sessions and face-to-face PBL referred to the conventional PBL sessions conducted in a small room in physical presence of both students and tutors.

For students, the inclusion criteria were all first and second year Bachelor in Medicine and Bachelor in Surgery (MBBS) students of PAHS who had attended online PBL and for tutors, all PBL tutors who had facilitated online PBL sessions. Among students, those who did not respond to the questionnaire and who were involved in the pretest were excluded. Among tutors, those who did not respond to the questionnaire, who were directly involved in the research and had assisted with the face validity were excluded.

In this study, we used a questionnaire for data collection. All authors involved in this study participated in developing the two sets of questionnaires, each for students and tutors. Face validity of the questionnaires was done by three Basic Science faculty members (faculty not involved in this study) and then were sent to two content experts of Health Professions Education Unit (HPEU) of PAHS for content validity. As per the suggestions, necessary changes were made.

Pretesting of the student's version of questionnaire was done using 13 students, six from first year and seven from second year (10% of the study population). Cronbach's alpha was calculated from the obtained data and was 0.92, which indicated 'excellent' reliability of the questionnaire. The final questionnaires were prepared in Google form. After approval from Institutional Review Committee (IRC), it was sent to students and tutors to their group e-mail id by the principal investigator. A time of one week was given to the study participants to fill up the questionnaire. Two other reminder emails were sent after the first mail in the gap of one week.

Likert scale score of each item was expressed in percentage or mean ± standard deviation. Dichotomous variables were presented in numbers and percentages. The three qualitative questions, regarding the advantage, disadvantage and suggestions, were analyzed by coding and categorizing into different themes.[7]

Ethical approval was obtained from IRC of PAHS (Ref. bss2104261518). Participation in the study was considered voluntary and consent was implied when the participants filled out the questionnaire sent via email. Students' identity was not revealed to the researchers as the questionnaire was sent through batch email and reply to the questionnaire was anonymous.

Result

The response rate was 79.2%, with 103 (48 from first year and 55 from second year) out of 130 participants completing the questionnaire. Among them, 45(43.69%) were male and 58(56.31%) were female. Likewise, among tutors, 10 (four male and six female) were involved in this study.

The mean age of students was 20.56±1.13 years, while that of tutors was 36.10±3.31 years. Majority of the

Table 1. Demographic data of students and tutors (n=103)

Parameters		Student	Tutor
		n(%)	n(%)
Mean age (years)		20.56±1.13	36.10±3.31
Stay during online PBL	Single room	42(40.78)	10(100)
	Shared room	61(59.22)	
Device	Laptop	83(80.58)	10(100)
	Desktop	3(2.91)	2(20)
	Hand held device (Mobile /Tablet)	79(76.70)	7(70)
Internet	Data package	7(6.80)	
	Wifi	37(35.92)	4(40)
	Both	59(57.28)	6(60)
Quality of internet	Unstable	21(20.39)	
	Average	74(71.84)	7(70)
	Stable	8(7.77)	3(30)
Quality of electric supply	Frequently interrupted	26(25.24)	
	Moderately interrupted	68(66)	4(40)
	Uninterrupted	9(8.74)	6(60)

students 61(59.22%) stayed in shared rooms during online PBL, whereas all tutors 10(100%) stayed in single rooms. Most students used laptops 83(80.58%) and handheld devices 79(76.70%) for online PBL. While 59(57.28%) of students had access to both data package and Wi-Fi, seven (70%) of tutors reported unstable internet connection. Frequent interruption of electricity was reported by 26(25.24%) of students and four (40%) of tutors, Table 1.

Sixty-eight (66%) students were satisfied with the online PBL, five (4.85%) were fully satisfied and 30(29.13%) were not satisfied. Among tutors, all were satisfied with online PBL and no one opted for fully satisfied or unsatisfied category. Regarding whether online PBL could be alternative to face-to-face PBL, almost half of both students 52(50.49%) and tutors five (50%) said yes.

In the comparative perception on online PBL and face-to face PBL of students, out of 26 items asked, majority of the students gave a neutral response to five of the items asked. They experienced that self-reflection, feedback from peers and tutors, guidance from tutor and conducive environment provided by them were equally effective in both online PBL and in face-to-face PBL.

In contrast to this, six (60%) of the tutors gave neutral response to the effectiveness of tutor's feedback in online PBL than in face-to-face PBL. Also, they disagreed to the role of self-reflection seven (70%) and peer's feedback five (50%) on improving performance in online PBL than in face-to-face PBL.

On the remaining 21 item, the number of students who disagreed or strongly disagreed on online PBL being more effective in fulfilling the learning objectives and promoted better retention of knowledge were 71(69%) and 88(85.44%) respectively. Likewise, 68(66.02%) students agreed or strongly agreed that interruption by group members were more in online PBL, whereas, gesture from peers 75(72.81%) and focus on discussion 71(68.93%) was less in online PBL, Table 2.

Tutors have agreed that collaborative learning nine (90%), group dynamics eight (80%) and flow of discussion seven (70%) were better in face-to-face PBL than in online PBL, Table 3.

Qualitative data analysis

To analyze further, the perception of the tutor and the students, three open-ended questions were asked to both groups, and the questions were related to advantages, disadvantages, and suggestions. Within these themes, 14 sub-themes were identified from students, and 8 sub-themes were identified from tutors, respectively. The quotations provided by the students are represented by S1, S2, and so on, and those offered by the tutor are represented by T1, T2, and so on.

Advantages

Useful in adverse situation

The biggest advantage identified by both the students and tutors was that the online PBL could be of great help when it is not practically possible to conduct face-to-face PBL sessions, and this would prevent academic loss.

"*In adverse situation which could push our academic calendar by long duration, online PBL is the only and best alternative to minimize this.*" (S30)

Flexibility

The online PBL that we conducted was a synchronous type, so all the students had to be present at the same time, however, they had the luxury to attend

Table 2. Comparative perception on online PBL and face-to face PBL of students on different aspects

Statements	Strongly disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly agree n(%)
1. Understanding of content is better in online PBL than face-to-face PBL	29(28.16)	45(43.69)	23(22.33)	5(4.85)	1(0.97)
2. Online PBL made the topic more interesting and fun learning than face-to-face PBL	28(27.18)	45(43.69)	26(25.24)	3(2.91)	1(0.97)
3. Online PBL helped me to learn more deeply than face-to-face PBL	30 (29.13)	45(43.69)	22(21.36)	5(4.85)	1(0.97)
4. I participated more actively in online PBL than in face-to-face PBL	11(10.68)	44(42.72)	37(35.92)	9(8.74)	2(1.94)
5. Hesitation to participate in group discussion was less in online PBL than in face-to-face PBL	12(11.65)	37(35.92)	23(22.33)	23(22.33)	8(7.77)
6. I am able to think more critically in online PBL than in face-to-face PBL	21(20.39)	41(39.81)	30(29.13)	10(9.71)	1(0.97)
7. Participation of group members is more homogeneous in online PBL than in face-to-face PBL	21(20.39)	48(46.60)	21(20.39)	12(11.65)	1(0.97)
8. Team spirit is better in online PBL than in face-to-face PBL	19(18.45)	53(51.46)	25(24.27)	5(4.85)	1(0.97)
9. Group dynamics is better in online PBL than in face-to-face PBL	17(16.50)	54(52.43)	22(21.36)	10(9.71)	-
10. I feel more comfortable in online PBL than in face-to-face PBL	19(18.45)	44(42.72)	28(27.18)	11(10.68)	1(0.97)
11. Use of power point/e-notes/pictures/other applications in online PBL enabled me to participate more easily than face-to-face PBL	8(7.80)	21(20.41)	29(28.16)	39(37.86)	6(5.83)
12. Use of power point/e-notes/pictures/other applications in online PBL clarified the explanations more than that of whiteboard in face-to-face PBL	17(16.50)	19(18.44)	29(28.16)	33(32.04)	5(4.85)
13. I experienced lack of discussion with friends regarding contents of PBL after online PBL sessions than face-to-face PBL	4(4.85)	6(5.83)	17(16.50)	40(38.83)	36(35.00)
14. I feel more tired (exhausted) after attending online PBL than face-to-face PBL	5(4.85)	19(18.44)	31(30.10)	33(32.04)	15(14.56)
15. Distractions are more in online PBL than in face-to-face PBL	3(2.91)	5(4.85)	8(7.76)	43(41.75)	44(42.72)
16. I am easily distracted in online PBL than in face-to-face PBL	2(1.94)	5(4.85)	19(18.44)	42(40.78)	35(34.00)

Table 3. Comparative perception on online PBL and face-to-face PBL of tutor on different aspects

Statements	Strongly disagree n(%)	Disagree n(%)	Neutral n(%)	Agree n(%)	Strongly agree n(%)
I was able to guide students more effectively in online PBL than in face-to-face PBL	1(10)	3(30)	6(60)	-	-
Group members acknowledged each other better in online PBL than in face-to-face PBL	-	7(70)	3(30)	-	-
I felt less connected with students in online PBL than face-to-face PBL	-	-	-	6(60)	4(40)
Tutor guide in soft copy format was difficult to use in online PBL than hard copy in face-to-face PBL	1(10)	2(20)	1(10)	3(30)	3(30)
Assessing the students was easier in online PBL than in face-to-face PBL	1(10)	6(60)	1(10)	1(10)	1(10)
Distractions are more in online PBL than in face-to-face PBL	-	-	3(30)	3(30)	4(40)
I was easily distracted in online PBL than in face-to-face PBL	1(10)	-	4(40)	4(40)	1(10)

the session from the area of comfort, and this feature was admired by both groups.

New technology

Students particularly enjoyed online PBL because of its various features, of which one particular element most students pointed out was the use of 3D pictures to make their discussion more fruitful. Likewise, for the tutors, the online-recorded feedback could be used for future reference.

"The online-recorded clip made it easier to capture

the information regarding the feedback given to the individual and to the group and this could be used as reference to assess the improvement over the time". (T5)

Better participation

To share one's opinion in a group might not be easy for everyone, and to recall what was read and give a rationale for the same might be even more difficult. Many students have admired the online platform in that it has made them less hesitant to participate.
"*I used to find speaking in group a little difficult but online platform has enhanced my confidence*" (S32).

Disadvantage

Technical issues and their effect

The major challenges faced by both groups were the issues regarding the frequent power cuts and unstable internet connection. Because of these technical issues, students were forced to log in repeatedly, which created interruptions in the group, distracted everyone, and affected the group dynamics during their discussion.

"I think the main limitation of online PBL lies in the technical aspect than in the discussion part itself. Due to poor internet connection or frequent electricity interruption, I could see many of my peers struggling to participate during the discussion" (S68).

"Also, o*nce we are disconnected, reconnecting takes time and by the time we are online, the discussion would have progressed. It takes time to adjust to the new point of discussion where peers have reached and be involved in it*" (S86).

Table 4. Theme – advantage, its subthemes and codes obtained from data analysis of student and tutor's perception

Student: Subtheme	Code
Useful in adverse situation	Prevents academic loss; Useful in conditions when offline PBL cannot be conducted
Flexibility	Ease of attending PBL session from anywhere
New technology	Familiarize with video streaming app; Ease to use pictorial diagrams which helped in comprehensive discussion; Sharing of board makes it easy to cover missed session
Better participation	Less hesitation to participate
Tutor: Subtheme	**Code**
Useful in adverse situation	Prevents academic loss; Good alternative when offline PBL cannot be conducted
Flexibility	Ease of attending PBL session from anywhere
New technology	Helped them in learning new technical skills; Students had a chance to learn about new online platform; Use of pictorial diagrams helped in in-depth discussion; Online recorded feedback could be used for further reference

Table 5. Theme – disadvantage, its subthemes, and codes obtained from data analysis of students and tutors' perception

Student: Subtheme	Code
Quick hacks	Can easily refer to book or internet in between the discussion
Technical issues	Electricity and internet problem
Technical issues hampering the discussion	Frequent interruption due to disconnection; Group dynamics affected due to technical errors; No homogenous participation; Frequent interruption from peers causing distraction; Easily distracted due to technical errors; Many pauses in between so waste of time; Once disconnected very difficult to carry on with discussion; Increased absenteeism; Difficult to manage time
Skill development	Lack of gestures from peers; No development of group skills; No face-to-face interactions; Not able to go in front and explain on the board
Learning process	Critically analyzing the trigger is diminished; Difficult to understand and explain the content; Less retention; Lack of concentration; Learning is also limited
Social isolation	Feeling of isolation; Less interaction; Less enthusiasm
Preparation from tutor side	Tutors are not able to modulate discussion well
Tutor: Subtheme	**Code**
Challenges created due to technical issues	Tutor not able to limit the various distraction (connectivity/background noise) Unable to observe the expression of the students; Less interactive; Students could use technical issues as an excuses to avoid participation
Difficult in assessment	All aspects of PBL cannot be assessed
Social isolation	Less connection with students

Table 6. Theme – suggestion, its subthemes and codes obtained from data analysis of student and tutor's perception

Student: Subtheme	Code
Technical aspects	Solving technical issues; Make use of innovative technique; Using flowcharts and other related technique to help during discussion; Alternatives if technical issues arises; To provide extra time to compensate for technical errors; Turning on the video to make the discussion more interactive
Role of tutor	Tutor must be more active; More guidance from tutor; Monitoring active participation and attendance; Timely feedback
Self-motivation	Students should be self-motivated to study; Turning on video could minimize the reading from other sources; Everyone should put an effort to make the session more interactive
Tutor: Subtheme	**Code**
Technical aspects	By turning on the camera; Ensuring technical support (good internet connection to all to be provided by institute); E-portal for sharing academic resources
Encouraging student's participation	More feedback to the students to be more responsible Strict action for consecutive absent

Likewise, tutors also have had trouble making the session interactive, as students could easily use technical issues as an excuse not to participate in the discussion.

"*We are not able to limit the distraction be it external, like connectivity issue, or be it in the group participation"* (T3).

Social isolation

Unlike face-to-face PBL, online sessions can be an isolating experience for both the students and tutors, which might hamper participation. Students have shared that they have felt less enthusiastic about the online session as there was less interaction among the peers.

"*I feel less connected with my students in online sessions*" (T11).

Quick hacks

Students were attending their online PBL sessions from home, which gave them an opportunity to refer to their books or have easy access to the internet to find the answers without others knowing how they had tackled the situation.

"We were not so much serious towards our studies because we could turn off the video and just read out the paragraphs from book or even find the answers in the internet and still be judged good" (S37).

Skill development

In a PBL session, we expect students to learn various skills like communication, teamwork, critical thinking, and self-directed learning. Students have shown dissatisfaction regarding their personal growth through the online PBL session.

"*Online PBL did not feel like a group discussion rather, it seemed as an individual work"* (S67).

"Sometimes students use slides during discussion, because of which it looks like a mini presentation rather than a group discussion" (T3).

Suggestions

Technical aspects

Students and tutors both have suggested that improving the technical aspects would create an engaging online learning environment. One important aspect identified by both was to turn on the camera during the synchronous sessions.

Self-motivation

Students have realized that in online PBL, they should be highly self-motivated as the tutors are not physically present, because of which the atmosphere is not the same as that in face-to-face PBL. They have shared various ways to keep them vigilant.

"We all should try to turn on the video during the online sessions. This would minimize distraction and would discourage us from simply reading the content from the book" (S11).

Discussion

This study tried to identify the perception of students and tutors on online PBL, its advantages, limitations and the suggestions. Due to the adverse situation like COVID-19, academic activity was on halt, and it was imperative to select alternative method to continue the activity, which provided us with deeper insight regarding the online platform for PBL.

With the help of this platform, it was possible to continue the regular PBL sessions, because of which the majority of the participants were satisfied with this. Students were also attracted towards the features of online platform as they could share pictures especially in Anatomy and this made the explaining easier for them. Likewise, tutors have also shared that the online-recorded feedback can be

used for future references. However, when asked if this platform could be alternative to face-to-face PBL, there was a mixed response from both the groups. This could be because of lack of proficiency in taking the online PBL and lack of exposure among students. Studies have shown that with the improvement in the technology and refinement in the delivery of PBL along with experiences and variety of learning material, the learning outcome can be improved.[8,9]

The other advantage was the geographical flexibility making it easier for the students to attend the PBL session from any part of the country. However, there was one major issue with this as many of our students were far from the main city due which they had to face fluctuation in power supply, hence, with the internet connection. As the learning was highly dependent on the internet connection, the technical issues that rose were the main hindrance during the discussion and being a synchronous session, frequent disruption could affect the individual participation as well as the group dynamics.[10] Due to this, students were easily distracted and were not able to think critically which affected the entire learning climate.[11] Frequent interruption could impede the flow of discussion, can reduce interest in the topic and may consume extra time thus making it difficult to complete the session within the given time. The various skill development, such as teamwork and communication, which are usually the objectives of PBL sessions, could not be accomplished. Thus, to conduct the online PBL sessions successfully and to minimize the dissatisfaction among the users, we have to overcome the issues related to technical aspect, which includes both the quality of technical support and skill among both the students and tutors in using them.[12]

One of the suggestions, agreed by both the students and tutors, related to technical aspect was that if the institute could provide technical support such as reliable internet access even in remote areas, then this could significantly enhance the effectiveness of online PBL, making the discussion productive and smoother. This improvement could make the online PBL experience more engaging and efficient for both students and tutors.

In the technical aspect, another issue identified by the participants was not turning on the camera by the students. There could be many reasons for this such as not wanting to disclose their location, family members might interrupt unknowingly but the major one could be unstable internet connection, which can affect the video streaming.[13,14] This is particularly difficult to tutors as they will not be able to assess the students on various aspects of PBL. First, if the tutors cannot see the students, then they cannot be sure of the presence of the students as they might login and not get involved in the discussion by making excuses related to technical aspects. Next, during the hypothesis generation, learning issues discussions or during any questions raised in between, tutors will not be able to differentiate if students are sharing what they have remembered or are directly reading from the book. Students have also shared that it was easier in online platform to turn off the camera and quickly look for the content, without others noticing them.[15,16] Lastly, without looking at the gestures from the students, it will be difficult for tutors to know the non-verbal cues like whether they have agreed to the peer's view or have disapprove of what they are saying. Thus, turning on the camera can help tutor assess the students better.

Another facet, which can be overcome by turning on the camera, is that it can minimize the feeling of social isolation and enrich the learning process.[17] This feeling of isolation, was one of the disadvantages identified by both the students and the tutors. Online session, despite being synchronous may not give the human touch and the minds may wander away during discussion. In situation like this, video conferencing, in one hand can maintain the focus on the topic as everyone can see the activities done by the other members and on the other hand, their gestures and eye contact can give the psychological effect of face-to-face interaction.[14]

However, turning on the camera may not be the only solution. Tutors need to explore ways to make the session more interactive and keep the student engaging in their own discussion. This may require special kind of training to the tutors, which was emphasized by both the students and the tutors in this study. Providing technology training can allow users to make maximum use of the online platform, be familiar with different inbuilt features and users will be more comfortable and will not feel foreign when using such platform for the first time.[6]

Another view shared was students expect more guidance from tutors in terms of monitoring their involvement in different steps of PBL and all participants have agreed that timely and constructive feedback to students is needed to make them more responsible and self-aware. This approach, not only helps students to identify their weaknesses, but also provides clear pathways for improvement.[18] Unlike face-to-face PBL, where tutor is physically present to assess all the aspects of PBL, in synchronous online platform, high level of motivation is required to achieve the similar goal and should learn to be more responsible towards their learning goal.[19] In this situation, timely feedback from tutors would be of great help.

The strength of this study is that it helped us to realize that conducting online PBL is possible and can be used in the adverse situation where physical presence is not possible. However, one major limitation was that, faculty did not have much past experience in the online facilitation though a short training for conducting online PBL was provided. In addition to this, the study was highly dependent on stable internet connection, which affected the participation and true comparison was challenging. This could be the reason why some students felt that there could be no alternative to face-to-face PBL.

Thus, if we focus more on providing equal access to technology, regular training to both the tutors and students, then it would be possible to implement synchronous online PBL in Basic Sciences years as an alternative to face-to-face PBL

Conclusion

This study has shown that synchronous form of online PBL can be a better alternative when face-to-face PBL is not possible to conduct among MBBS students. Exposure to new technology and flexibility in location, were some of the advantages identified. However, there were limitations primarily related to the technical issues as not everyone had access to same quality of internet. Due to this, the skills that we wanted students to develop through PBL like teamwork, critical thinking and communication were not achieved. To address these challenges, availability of standard technical infrastructures followed by proper guidance from the tutor and lastly self-motivation among students were suggested.

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Conflicting Interest

None

Authors contributions

Concept, design, planning: RB, RPD, PP, JB, SA, BRM; Literature review: RB, SA; Data collection: RB, PP, SA, BRM; Data analysis: RB, PP; Draft manuscript: RB; Revision of the draft: RB, RPD, PP, JB, SA, BRM; Final manuscript: RB, RPD, PP, JB, SA, BRM; Accountability of the work: RB, RPD, PP, JB, SA, BRM.

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