

ORIGINAL ARTICLE

EFFECTIVENESS OF PROBLEM BASED LEARNING AS A STRATEGY TO FOSTER PROBLEM SOLVING AND CRITICAL REASONING SKILLS AMONG MEDICAL STUDENTS

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Background: Problem based learning (PBL) is an instructional approach that utilizes problems or cases as a context for students to acquire problem solving skills. It promotes communication skills, active learning, and critical thinking skills. It encourages peer teaching and active participation in a group. **Methods:** It was a cross-sectional study conducted at Al Nafees Medical College, Isra University, Islamabad, in one month duration. This study was conducted on 193 students of both 1st and 2nd year MBBS. Each PBL consists of three sessions, spaced by 2–3 days. In the first session students were provided a PBL case developed by both basic and clinical science faculty. In Session 2 (group discussion), they share, integrate their knowledge with the group and Wrap up (third session), was concluded at the end. A questionnaire based survey was conducted to find out overall effectiveness of PBL sessions. **Results:** Teaching through PBLs greatly improved the problem solving and critical reasoning skills with 60% students of first year and 71% of 2nd year agreeing that the acquisition of knowledge and its application in solving multiple choice questions (MCQs) was greatly improved by these sessions. They observed that their self-directed learning, intrinsic motivation and skills to relate basic concepts with clinical reasoning which involves higher order thinking have greatly enhanced. Students found PBLs as an effective strategy to promote teamwork and critical thinking skills. **Conclusion:** PBL is an effective method to improve critical thinking and problem solving skills among medical students.

Keywords: PBL, effectiveness, medical students, learning, problem solving

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INTRODUCTION

Problem based learning (PBL) has been practiced as an integral component of medical curricula around the world and is now becoming extremely important component of integrated curriculum in Pakistan.¹ It is a methodology of learning that promotes critical thinking amongst students but also improves communication skills. This has been proved by many studies done in different parts of world.^{2–4} Now a days there is a hot debate on taking feedbacks of PBL and to plan methodology to develop the tools for analysis and assessment of this strategy.⁵ Process of giving feedback is also very important. The students should be trained to give feedback of PBL sessions.

Through feedback, individuals not only recognize areas of deficiency in their knowledge and skills but also areas of their strength. Studies have shown that feedback can improve performance in history taking skills⁶, examination skills⁷, and technical skills⁸ and teaching ability.⁹ It is a natural phenomenon that when we assess a process it enables the participants to tolerate self-criticism which helps them improve such self-directed skills in professional life.¹⁰

Since the learning is self-cantered; taking feedback from students also helps to determine the areas of their interest and also assess their own

work.¹¹ Studies done in past on feedback are mostly a comparison of students experiencing PBL sessions and those who are not going through this experience.^{11–14} But we need to know whether different groups achieve the same level of competencies while doing PBL sessions during different modules. So keeping this in mind this study was conducted to assess the effectiveness of PBL as a learning tool to foster critical thinking and problem solving skills among medical students with the specific objective to assess the effectiveness of PBL as a learning tool to foster critical thinking and problem solving skills among medical students.

MATERIAL AND METHODS

This cross sectional study was carried out on first and second year students of MBBS (Session 2012 and 2013) of Al Nafees Medical College, Islamabad, in one month duration with a total 193 students: 99 students of 1st and 94 students of 2nd year were divided into eight groups with each group having 12–13 students.

A well trained facilitator was allotted to each group. The students were randomly selected and groups were formulated. PBL was practiced in three sessions with an interval of 2–3 days, based on Maastricht's "seven jump" process with a little

modification, i.e., conducting a ‘Wrap Up session’ at the end of the PBL. In First PBL session a problem from Immunity Blood Lymphatic System (IBLS) and Gastro Intestinal Tract (GIT) Module to first year and second year were introduced respectively. Students identified the learning objectives related to that particular case followed by self-assigned tasks and discussions in the subsequent sessions. They were also allowed to go library and refer to the books. Second session, i.e., brainstorming phase, is an effective procedure to activate knowledge and to elaborate on knowledge and acquire comprehension of relevant new information.

Facilitators were watching the students while discussing and corrected them by giving some clues on deviation. In the third session, “Wrap Up” of the case was conducted by the clinical faculty. Students were asked to demonstrate their acquired knowledge in the form of power point presentations.

A questionnaire consisting of a three-point Likert scale was given to the students at the end of “Wrap Up” session to know their feedback about knowledge regarding problem based learning and their acceptance towards it. Questionnaire had 10 items and an open-ended question about PBL effectiveness. Descriptive information about the age and gender of the students was also collected. Facilitators (who had actively participated in all the three sessions of PBL) and students were asked to rate (1: minimum, 3: maximum) to each item of the scale regarding the outcomes of PBL. Data was entered and analysed on SPSS version 16.0.

RESULTS

Out of 193 students, 99 boys and 94 girls participated in the study. Survey response rate was -100%. Averages and percentages for each response on given Likert scale were determined along with the overall effectiveness of PBL. Tables 1 and 2 showed that Self Directed Learning skill was improved by PBL sessions in 73% students of 1st year. Sixty one per cent of first year and seventy two per cent of second year students thought that PBLs have promoted their skills to think critically.

Ability to apply basic concepts with reasoning was observed in 83% students of second year after participating actively in these sessions. As compared to first year, second year medical students believed that their intrinsic motivation had also increased significantly (54% and 74% respectively). Facilitation of communication skills was achieved in 73.7% students of 2nd year as shown in figure-1.

Table-1: Perception of first year students towards effectiveness of PBL as a learning tool

| Items | A | B | C | Total (%) |
|--|------------|------------|-----------|-----------|
| Facilitation of problem solving skills | 49 (60.5) | 25 (30.9) | 7 (8.6) | 81 (100) |
| Facilitation of communication skills | 59 (72.8) | 15 (18.5) | 7 (8.6) | 81 (100) |
| Facilitation of self-directed learning | 59 (72.8) | 19 (23.5) | 3 (3.7) | 81 (100) |
| Gaining basic science knowledge | 51 (63.0) | 18 (22.2) | 11 (13.6) | 80 (100) |
| Facilitation of integration of basic and clinical knowledge | 44 (55.0) | 29 (36.25) | 7 (8.75) | 80 (100) |
| Increasing intrinsic motivation of student | 43 (53.09) | 30 (37.04) | 8 (9.88) | 81 (100) |
| Facilitation of development of self-assessment | 42 (51.9) | 28 (34.6) | 10 (12.3) | 80 (100) |
| Was the class time well used | 44 (54.3) | 24 (29.6) | 13 (16.0) | 81 (100) |
| Were the major objectives of the case made clear | 55 (67.9) | 17 (21.0) | 9 (11.1) | 81 (100) |
| Did the facilitator encourage critical thinking and analysis | 46 (58.9) | 19 (24.3) | 13 (16.6) | 78 (100) |

Table-2: Perception of second year students towards effectiveness of PBL as a learning tool:

| Items | A | B | C | Total |
|--|-----------|-----------|-----------|------------|
| Facilitation of problem solving skills | 68 (71.6) | 19 (20.0) | 8 (8.4) | 95 (100.0) |
| Facilitation of communication skills | 70 (73.7) | 21 (22.1) | 4 (4.2) | 95 (100.0) |
| Facilitation of self-directed learning | 73 (76.8) | 16 (16.8) | 6 (6.3) | 95 (100.0) |
| Gaining basic science knowledge | 79 (83.2) | 15 (15.8) | 1 (1.1) | 95 (100.0) |
| Facilitation of integration of basic and clinical knowledge | 51 (57.4) | 31 (33.0) | 8 (8.5) | 94 (100.0) |
| Increasing intrinsic motivation of student | 51 (73.7) | 19 (20.0) | 5 (5.3) | 94 (100.0) |
| Facilitation of development of self-assessment | 51 (53.7) | 36 (37.9) | 8 (8.4) | 95 (100.0) |
| Was the class time well used | 72 (76.6) | 20(21.3) | 2 (2.1) | 94 (100.0) |
| Were the major objectives of the case made clear | 55 (58.5) | 25 (26.6) | 13 (13.8) | 94 (100.0) |
| Did the facilitator encourage critical thinking and analysis | 58 (64.4) | 25 (27.8) | 7 (7.8) | 90 (100.0) |

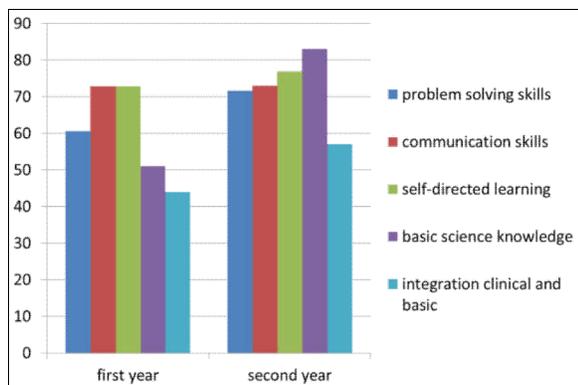


Figure-1: Comparison of effectiveness of PBL in first and second year students

DISCUSSION

Small group teachings not only helps in acquisition of knowledge but also improves communication, problem solving and team work learning skills in students.¹⁵ Clinical based scenarios helps in better understanding of prior knowledge, improvement in their problem solving skills and makes them self-learners.¹⁶ In this study 49% of first year students felt and 68% of second year students felt that they developed problem solving skills. Machado JL and et al have proposed different methods for assessment of PBL process.¹⁷ Chegwidien in his study has shown that second year students respond to PBL more effectively as compared to first year.¹⁸ This has been clear from this study that second year showed better response as compared to first year. The more a group is exposed to PBL the more they start enjoying the freedom to discuss issues amongst the group. In some studies it has been seen that problems arouse situational interest that increased interest in learning. We further found that students conceptualized a good group in terms of how they interacted with each other and how they discussed and worked through the problems. Schmidt HG has emphasized that the extent of learning in PBL results from neither group collaboration only nor individual knowledge acquisition only; both activities contribute equally to learning in PBL.¹⁹ Gwee MC has proposed that the students understood the role played by PBL process of collaborative work in small groups with relation to the development of a learning culture, which encouraged both teamwork and self-directed learning.²⁰

Fifty One Percent of first year and 79% students of second year felt improvement in gaining basic scientific knowledge (Graph-1). Neill has emphasized that regardless of the generation of faculty or student objectives, important outcomes are whether our students' knowledge and understanding of basic science continues to grow as they proceed

through the course.²¹ In this study it was highlighted that PBLs helps in integration of basic and clinical knowledge. This highlights the fact that integration of basic and clinical knowledge will help them in generating hypothesis for future research. Many studies and reports suggest that the PBLs encourage them to use internet sites and reference books. Forty-two per cent of first year and 58% of second year students agreed that the class time was well used. Forty-four per cent of first year and 63% of second year students agreed that the major objectives of the case were made clear. Active participation of the students helps in better understanding of the subject and group activity had improved their social interaction, presentation and peer review skills.¹⁹ Facilitation is not about detailed content or what the group works on, it is more about how the group approaches big concepts, identifies open ended questions that encourage group discussion and how the group identifies their learning needs and what they need to know.²⁰ In one study the PBL facilitators have been guided how to make certain rules for themselves in order to become good facilitators.²¹ Forty-four per cent of first year and 63% of second year students agreed that the facilitator encouraged critical thinking and analysis. Facilitators are responsible to create the environment that is conducive for learners to construct their own knowledge, skills and values through interaction.²² Most of the studies have emphasized the fact that although lectures and s are also effective learning tools but PBLs encourage critical thinking which is usually not possible in lectures. PBL graduates tend to engage in background reasoning rather than the forward reasoning experts engage in, and there appeared to be gaps in their cognitive knowledge base that could affect practice outcomes.²³ The utilization of class time is also an art. It is the responsibility of the team to point out areas for which more time should be utilized and areas which need little explanation.²⁴ Both first and second year students agreed that the class time was well utilized. In a country like Pakistan there is difference in level of competence of students in different pre medical school. The students studying in schools affiliated with Cambridge University are subjected to PBL sessions in premedical schools. So they perform well in PBL. Also background of students matters. Some come from rural area and some from main cities of Pakistan. Hence the use and effectiveness of PBL are not isolated from the cultural and social structural context in which it is applied. One interesting aspect of this study was the population of students who disagreed the facts regarding effectiveness of PBL. The interesting thing is that about 30% of second year students disagreed that PBL was of help in

development of self-assessment skills and 25% also not happy because they thought that major objectives of the case were not made clear to them. One third of first year students felt that PBL failed to increase intrinsic motivation of students. But the majority of students both from first and second year agreed that PBL is an effective learning tool and it works to engage students in self-directed learning.

CONCLUSION

PBL is an effective method to improve critical thinking and problem solving skills among medical students.

AUTHOR'S CONTRIBUTION

MA: Principal investigator, writing of manuscript, collection of data, KI: Collection and interpretation of data, SF: Data Analysis

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