

Attitude of Medical Students towards Biochemistry and Its Integration through Problem-Based Learning

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ABSTRACT

Introduction: Biochemistry is an important but volatile subject for undergraduate medical students and is included in integrated organ-based system with problem-based learning method in the curriculum of Kathmandu University School of Medical Sciences.

Objective: This study was conducted to assess students' attitudes toward Biochemistry and its integration into problem-based learning.

Methods: It was a descriptive cross-sectional study that lasted 5 months (October 2020-February 2021) after ethical approval from the Institutional Review Committee- KUSMS. Among 150 students participated in the study, 51 were girls and 99 were boys. After taking consent, a pretested self-assessment semi structured questionnaire with a five point Likert scale for each question was used. Out of the statements in the questionnaire, eight questions were positive statements. Mean for each statement was calculated along with average mean score for each positive and negative statements.

Results: The mean positive score was 3.06 for the attitude towards studying Biochemistry. The mean score towards the negative statements was 2.4. The mean score was 3.36 for positive statements towards attitude of students towards integration of Biochemistry in problem-based learning whereas the mean score of negative statements was 3.41.

Conclusions: Students had overall positive attitude towards studying Biochemistry and its integration into an organ system based curriculum using problem-based learning.

Keywords: Biochemistry; curriculum; problem-based learning.

INTRODUCTION

Biochemistry is one of the key basic science courses taught in the first and second years of a standard medical curriculum.¹ However, basic science knowledge obtained during typical preclinical years has been proven to suffer significant loss by the time medical students reach clinical years.² To address these issues, problem-based learning (PBL) has been introduced, which consists of three steps: starting learning with a problem, solving the problem with interdisciplinary knowledge, and working

collaboratively with classmates to solve the problem under the guidance of instructors (or tutors).³ PBL is a student-centered, self-directed, integrated, and contextual form of learning pioneered by Barrows in the 1960s.⁴

Since 2001, PBL has been an integral part of the curriculum at Kathmandu University School of Medical Sciences (KUSMS), accounting for one-third of total academic hours.^(5,6) Biochemistry curricular content can be effectively integrated with all other basic and clinical sciences through the use of relevant clinical case scenarios and PBL.⁷

Because the success of a curriculum is also determined by pupils' attitudes toward it. This study was conducted to better understand students' attitudes and perspectives on the importance of Biochemistry and its teaching methods, as well as

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to identify issue areas so that required actions can be taken to improve educational quality.

METHODS

It was a descriptive cross-sectional study, including the first and second-year medical students, done for a period of five months (October 2020–February 2021) after ethical approval from the Institutional Review Committee of Kathmandu University School of Medical Sciences (IRC-KUSMS). All the students who consented were included in the study. After obtaining written consent, a self-assessment, semi-structured questionnaire was used (Table 5). The questionnaire consists of a total of 32 questions, with the results plotted on a 5-point Likert scale. The students were instructed briefly about the statements in the questionnaire. Then, the questionnaire was distributed in hard copy, which was to be filled out and returned after a week in the absence of the researchers. Demographic information (class, gender, and age) was also obtained. Data were entered and analyzed using SPSS Statistics for Windows, Version 16.0 (SPSS Inc., Chicago, III, USA).

Mean score for each statement in the questionnaire and the overall mean score were calculated. After receiving the completed questionnaire sheets from the students, the score was given for each statement as follows: Likert scale ranged from one to five, where one indicated strongly disagree, two for disagree, three for neutral, four for agree and five for strongly agree.

The questionnaire consisted of both negative and positive statements. The high score on positive statements and the low score on negative statements meant that the students had positive attitude. Likewise, low score on positive statement and high score on negative statement inferred negative attitude. Out of the statements in the questionnaire, 8 questions (3, 4, 5, 9, 10, 10, 11, 12, 13) were positive statements.

Statements from 1-18 were about the attitude of students towards Biochemistry and questions 19-32 were the attitude of students towards integration of Biochemistry in PBL.

RESULTS

There were altogether 160 students in the first and second year combined and only 150 students consented to participate in the study. Among them 51 were girls and 99 were boys.

The mean positive score was 3.06 for the attitude towards studying Biochemistry which means students were inclined towards studying Biochemistry as given in table 1. The students were more positive for the statement “Pre-clinical Biochemistry courses would be very helpful no matter what PG course I decide to study in future.”

The mean score towards the negative statements was 2.24 which signifies the students less inclinations towards negative questions regarding attitude towards Biochemistry as given in table 2. Especially to statement, “I do not expect to use Biochemistry in patient care.”

The mean score was 3.36 for positive statements towards attitude of students towards integration of Biochemistry in PBL as shown in table 3. “Especially to the statement, Biochemistry discussion during PBL helps to link and integrate knowledge with other preclinical subjects”.

The overall mean score of negative statements was 3.41 which indicates inclination of the students towards negative statements regarding integration of Biochemistry in PBL as shown in table 4. The highest scoring statement being “I would like Biochemistry to be more closely integrated with the clinical sciences and would like real cases from the hospital to be used during lectures and PBL.”

Table 1: Mean score for positive statements for attitude towards studying Biochemistry.

| S.N. | Statements | Mean score |
|------------|--|------------|
| 1 | I am able to understand Biochemistry without much difficulty | 2.9 |
| 2 | I can do well on Biochemistry test. | 3.1 |
| 3 | The subject has created a knowledge base which will help me in understanding disease mechanism in future practice. | 2.5 |
| 4 | The subject has helped me to develop my problem solving and logical reasoning skills. | 2.9 |
| 5 | Pre-clinical Biochemistry courses would be very helpful no matter what PG course I decide to study in future. | 3.8 |
| 6 | Biochemistry is one of the most important subject in medical sciences. | 3.7 |
| 7 | Biochemistry is my favourite subject in pre-clinical sciences | 2.5 |
| 8 | I find the Biochemistry interesting and stimulating. | 3.3 |
| 9 | I like to study Biochemistry in detail and as much as possible. | 3.1 |
| 10 | I would welcome modules on Biochemistry and molecular biology during clinical years of my training | 3.6 |
| 11 | I will consider Biochemistry as one of my subjects for post graduation. | 2.3 |
| Mean score | | 3.06 |

Table 2: Mean score for negative statements for the attitude towards Biochemistry.

| S.N. | Statements | Mean score |
|------------|--|------------|
| 1 | I feel nervous while studying Biochemistry. | 2.6 |
| 2 | I am always under a terrible strain in a Biochemistry class | 2.3 |
| 3 | I do not expect to use Biochemistry in patient care. | 1.9 |
| 4 | Learning metabolic pathway are irrelevant in medical education | 1.9 |
| 5 | Learning chemistry of biological compounds like carbohydrates, fats and amino-acids, nucleic acids are irrelevant in medical education | 2.1 |
| 6 | Biochemistry is dull and boring. | 2.4 |
| 7 | I consider learning Biochemistry just to get pass score in the exam. | 2.5 |
| Mean Score | | 2.24 |

Table 3: Mean score for positive statements regarding integration of Biochemistry in PBL.

| S.N. | Statements | Mean score |
|--------------------|--|------------|
| 1 | PBL is effective in learning Biochemistry. | 3.4 |
| 2 | I consider PBL in stimulating critical thinking in Biochemistry. | 3.4 |
| 3 | I always look forward to learn and discuss Biochemistry portion. | 3.5 |
| 4 | Searching for answers to the learning issues in Biochemistry is exciting | 3.2 |
| 5 | Students in my groups are supportive and willing to discuss Biochemistry during PBL session. | 3.3 |
| 6 | I would like to have more cases specially designed to learn Biochemistry. | 3.6 |
| 7 | Biochemistry discussion during PBL helps to link and integrate knowledge with other preclinical subjects | 3.8 |
| 8 | I prefer PBL in learning Biochemistry than lecture method | 2.7 |
| Overall mean score | | 3.36 |

Completed questionnaire by the students Table 5. Here, the most agreeable statement is “Biochemistry discussion during PBL helps to link and integrate knowledge with other preclinical subjects”. Similarly, the statement “Learning chemistry of biological compounds like carbohydrates, fats and amino-acids, nucleic acids are irrelevant in medical education” is mostly disagreed by the students.

DISCUSSION

Biochemistry is essential for modern medicine, but many consider it an unnecessary burden. This study aimed to evaluate students' attitudes towards biochemistry and its integration into an organ-based curriculum using PBL.^{8,9}

Table 4: Mean score for negative statements for integration of biochemistry in PBL.

| S.N. | Statements | Mean score |
|--------------------|--|------------|
| 1 | I would like biochemistry to be more closely integrated with the clinical sciences and would like real cases from the hospital to be used during lectures and PBL. | 4.2 |
| 2 | I would like the subject/ cases to focus more strongly on the health problems of South Asia with special emphasis on Nepal. | 4.1 |
| 3 | Group interaction during biochemistry portion is not sufficient. | 3.5 |
| 4 | I feel difficulty in sharing ideas and knowledge while discussing biochemistry during PBL. | 2.7 |
| 5 | Tutors were not encouraging biochemistry discussion during PBL session. | 2.9 |
| 6 | Metabolic pathways and chemistry portion cannot be learnt by PBL method. | 3.1 |
| Overall mean score | | 3.41 |

Table 5: Questionnaire with students’ response for each statement.

| S. N. | Item questions | Strongly disagrees | Disagree | Neutral | Agree | Strongly agree |
|-------|--|--------------------|-----------|-----------|-----------|----------------|
| 1 | I feel nervous while studying biochemistry. | 14(17.7%) | 51(28.0%) | 53(29.1%) | 31(17%) | 0 |
| 2 | I am always under a terrible strain in a biochemistry class | 32(17.6%) | 63(34.6%) | 27(14.8%) | 27(14.8%) | 0 |
| 3 | I am able to understand biochemistry without much difficulty | 9(4.9%) | 37(20.3%) | 61(33.5%) | 42(23.1%) | 0 |
| 4 | I can do well on biochemistry test. | 0 | 23(12.6%) | 79(43.4%) | 43(23.6%) | 4(2.2%) |
| 5 | The subject has created a knowledge base which will help me in understanding disease mechanism in future practice. | 2(1.1%) | 62(34.1%) | 18(9.9%) | 9(4.9%) | 3(1.6%) |
| 6 | I do not expect to use biochemistry in patient care. | 57(31.3%) | 62(34.1%) | 18(9.9%) | 9(4.9%) | 3(1.6%) |
| 7 | Learning metabolic pathway are irrelevant in medical education | 50(27.5%) | 74(40.7%) | 9(4.9%) | 16(8.8%) | 0 |
| 8 | Learning chemistry of biological compounds like carbohydrates, fats and amino-acids, nucleic acids are irrelevant in medical education | 36(19.8%) | 80(44.0%) | 15(8.2%) | 18(9.9%) | 0 |
| 9 | The subject has helped me to develop my problem solving and logical reasoning skills. | 9(4.9%) | 40(22.0%) | 51(28.0%) | 46(25.3%) | 3(1.6%) |
| 10 | Pre-clinical biochemistry courses would be very helpful no matter what PG course I decide to study in future. | 0 | 12(6.6%) | 34(18.7%) | 73(40.1%) | 30(16.5%) |

| | | | | | | |
|----|--|-----------|-----------|-----------|------------|-----------|
| 11 | Biochemistry is one of the most important subject in medical sciences. | 0 | 16(8.8%) | 26(14.3%) | 79(43.4%) | 28(15.4%) |
| 12 | Biochemistry is my favourite subject in pre-clinical sciences | 24(13.2%) | 48(26.4%) | 55(30.2%) | 16(8.8%) | 6(3.3%) |
| 13 | I find the biochemistry interesting and stimulating. | 6(3.3%) | 12(6.6%) | 67(36.8%) | 53(29.1%) | 11(6.0%) |
| 14 | Biochemistry is dull and boring. | 22(12.1%) | 71(39.0%) | 16(8.8%) | 40(22.0%) | 0 |
| 15 | I like to study biochemistry in detail and as much as possible. | 9(4.9%) | 44(24.2%) | 25(13.7%) | 59(32.4%) | 126(6.6%) |
| 16 | I would welcome modules on biochemistry and molecular biology during clinical years of my training | 0 | 3(1.6%) | 57(31.3%) | 83(45.6%) | 6(3.3%) |
| 17 | I will consider biochemistry as one of my subjects for post graduation. | 31(17.0%) | 52(28.6%) | 55(30.2%) | 11(6.0%) | 0 |
| 18 | I consider learning biochemistry just to get pass score in the exam. | 17(9.3%) | 69(37.9%) | 39(21.4%) | 18(9.9%) | 6(3.3%) |
| 19 | I would like biochemistry to be more closely integrated with the clinical sciences and would like real cases from the hospital to be used during lectures and PBL. | 0 | 9(4.9%) | 9(4.9%) | 68(37.4%) | 63(34.6%) |
| 20 | I would like the subject/ cases to focus more more strongly on the health problems of South Asia with special emphasis on Nepal. | 7(3.8%) | 4(2.2%) | 14(7.7%) | 63(34.6%) | 61(33.5%) |
| 21 | PBL is effective in learning biochemistry. | 9(4.9%) | 22(12.1%) | 44(24.2%) | 47(25.8%) | 27(14.8%) |
| 22 | I consider PBL in stimulating critical thinking in biochemistry. | 6(3.3%) | 15(8.2%) | 54(29.7%) | 49(26.9%) | 25(13.7%) |
| 23 | I always look forward to learn and discuss biochemistry portion. | 0 | 16(8.8%) | 43(23.6%) | 84(46.2%) | 6(3.3%) |
| 24 | Searching for answers to the learning issues in biochemistry is exciting | 6(3.3%) | 25(13.7%) | 50(27.5%) | 55(30.2%) | 13(7.1%) |
| 25 | Group interaction during biochemistry portion is not sufficient. | 10(5.5%) | 28(15.4%) | 10(5.5%) | 74(40.7%) | 27(14.8%) |
| 26 | I feel difficulty in sharing ideas and knowledge while discussing biochemistry during PBL. | 9(4.9%) | 64(35.2%) | 34(18.7%) | 39(21.4%) | 3(1.6%) |
| 27 | Students in my groups are supportive and willing to discuss biochemistry during PBL session. | 10(5.5%) | 16(8.8%) | 42(23.1%) | 72(39.6%) | 9(4.9%) |
| 28 | Tutors were not encouraging biochemistry discussion during PBL session. | 9(4.9%) | 57(31.3%) | 26(14.3%) | 48(26.4%) | 9(4.9%) |
| 29 | I would like to have more cases specially designed to learn biochemistry. | 3(1.6%) | 21(11.5%) | 31(17.0%) | 61(33.5%) | 33(18.1%) |
| 30 | Metabolic pathways and chemistry portion cannot be learnt by PBL method. | 6(3.3%) | 44(24.2%) | 33(18.1%) | 48(26.4%) | 18(9.9%) |
| 31 | Biochemistry discussion during PBL helps to link and integrate knowledge with other preclinical subjects | 3(1.6%) | 6(3.3%) | 22(12.1%) | 100(54.9%) | 18(9.9%) |
| 32 | I prefer PBL in learning biochemistry than lecture method | 18(9.9%) | 49(26.9%) | 45(24.7%) | 19(10.4%) | 18(9.9%) |

The average score for positive statements towards Biochemistry is 3.06, which is a response to the agreement on the benefits of studying Biochemistry. The average of the core negative questions towards Biochemistry is 2.24, which means a slight disagreement towards negative statements regarding the importance of Biochemistry. This shows that our students are somehow positive towards studying Biochemistry in the organ-based curriculum.

Therefore, we also had a questionnaire regarding attitude of students towards integration of Biochemistry in PBL in which the response towards the average positive question is 3.36 which is a response in the agreement towards its benefits. Whereas, the average of negative questions towards Biochemistry is 3.41 which is a response in the agreement towards negative view about integration of Biochemistry in PBL.

A part of this positive attitude could be due to the PBL system implemented in our curriculum. KUSMS follows Barrows' PBL model, where students are active in learning in small student groups, ideally consisting of six to ten students, with tutors or facilitators to guide the students rather than teach.⁶ In a study done in Patan Academy of health sciences (PAHS), PBL was found to be fun, providing contextual learning with long term retention of knowledge through students' active participation in a small group.⁷ A similar study done at the B.P. Koirala Institute of Health Sciences (BPKIHS) showed that the students had a positive attitude towards the PBL method of teaching and learning activity.¹⁰

Integrating PBL, which is also a case-based method, into the teaching of Biochemistry has been shown to promote thoughtfulness in students, which expands their knowledge base by providing important lessons in clinical medicine while studying basic clinical Biochemistry.¹¹

A study on the implementation of a new concept-mapping program as a learning tool to teach Biochemistry has been done at Saveetha Medical College and Hospital (India). The result showed a higher academic performance compared to the traditional course and was perceived favorably by the students.¹

In another study done by Hadimani, a short group discussion session was included to overcome the limitations of only lectures. This method facilitated students' better understanding and application of biochemical principles to clinical cases and the development of communication skills.¹²

CONCLUSION

Students had overall positive attitude towards studying Biochemistry and its integration into an organ system based curriculum using problem-based learning. To successfully incorporate PBL in the organ-based curriculum and other ways other than standard didactic lectures, students will need to undertake time-consuming database searches as well as critically read, evaluate, and analyze a vast amount of medical information. It will instill a sense of importance and utility in basic science courses such as Biochemistry. Biochemistry professors (or instructors from other fundamental science disciplines), PBL instructors, and students should collaborate to create a hybrid system for evaluating, integrating, and interpreting basic science with clinical knowledge.

Conflict of Interest: None.

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