

Case Based Learning: A Method for Better Understanding of Biochemistry in Medical Students

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ABSTRACT

Introduction: Health professionals need to develop analytic and diagnostic thinking skills and not just a mere accumulation of large amount of facts. Hence, Case Based Learning (CBL) has been used in the medical curriculum for this reason, so that the students are exposed to the real medical problems, which helps them in develop analysing abilities. This also helps them in interpreting and solving the problems and in the course of doing this, they develop interest. In addition to didactic lectures, CBL was used as a learning method.

Methods: This study was conducted in the Department of Biochemistry, S.B.K.S.M.I and R.C, Sumandeep Vidyapeeth, Piparia, Gujarat, India. A group of 100 students were selected and they were divided into two groups as the control group and the study group. A total of 50 students were introduced to case

based learning, which formed the study group and 50 students who attended didactic lectures formed the control group.

Results: A very significant improvement ($p < 0.0001$) was observed among the students after the CBL sessions and they were also motivated by these sessions. A 4 point Likert scale questionnaire which contained 8 questions was administered to the students, to know their perception on the usefulness of the CBL. 98% of the students reported that they found the CBL sessions to be an interesting method of gaining knowledge. 84% of them felt that they exposed them to an experience of logical application of the knowledge which was gained in cracking cases, which would be of great help in the future also.

Conclusion: Case Based Learning (CBL) was used and it is effective in the medical curriculum for a better understanding of Biochemistry among the medical students.

Key words: Case based learning, Innovative teaching methods, Biochemistry, Undergraduate medical curriculum, Medical education

INTRODUCTION:

Biochemistry is one of the foundation sciences in the medical curriculum, which has immense importance in understanding the future clinical sciences, but it is generally considered to be a subject of just countless biochemical structures, pathways and reactions. In the traditional system of medical education, it was mainly taught by means of didactic lectures, tutorials and practical classes, along with anatomy and physiology in the first year of the medical course of four and a half years duration. Hence, it was teacher centered, with minimal active participation from the students and hence, the students lacked critical thinking. But these days, the education system is changing to a student centered teaching-learning process with the use of various innovative teaching methods. This makes the students actively involved in the process of learning and it thus prepares them for a lifelong self directed learning process [1]. As a result of this, students can have a meaningful learning, wherein the learner is motivated for effective learning rather than just the dispensing of information [2]. Learning is actually a process which results in some changes or modifications in the learners' ways of thinking, feeling and doing as a result of practice, in this process sequential learning and integrated it with previous knowledge. Integrated teaching is an important strategy for promoting meaningful learning and for making it easily retainable by the learner. Many approaches are available for integrating the basic and clinical sciences. Case Based Learning (CBL) is one such approach which can make learning more effective and interesting.

In fact, it is now an established active learning tool which aims at developing reasoning skills, based on the clinical scenarios and hence, a medical student understands the importance of the basic medical science subjects [3]. The clinical case which is given, acts as a stimulus and so the learner is motivated to gain knowledge. But this process is guided, as the facilitator plays a minimal role, but guides the learner.

At SBKSMI and RC, a part of Sumandeep Vidyapeeth, the teaching approach which was used was incorporation of innovative teaching methods, to make the learning process student centered. Hence, this study was conducted in the Department of Biochemistry, to compare the academic performance of the undergraduate medical students by using traditional methods and innovative methods (CBL).

MATERIAL AND METHODS

This study was conducted in the Department of Biochemistry, S.B.K.S.M.I and R.C, Sumandeep Vidyapeeth, Piparia, Gujarat, India during the academic year, 2012-13. Case based learning was introduced along with didactic lectures in the Biochemistry teaching curriculum, during a tutorial class. The study group ($n=50$) had students who were self motivated by giving them a clinical problem. The other group ($n=50$) had the same teacher teaching the topic in a didactic lecture form. The interventional group was presented with a clearly defined, short clinical problem which was related to that topic in the tutorial classes [4]. The case (Appendix-A) was the symptoms of a particular disorder of a system, which were made very clear. They were given time to define, and to resolve the problem. Subsequently, the students were given the specific learning objectives (Appendix-B). The facilitator, during the phase, also motivated and guided the students for learning, by assisting the students through the facts and engaging them in reading to find a possible solution to the problem. Then, during the next session, the case was discussed under the guidance of the facilitator, properly and systematically, taking care to ensure that every student participated in it. Relevant questions were asked by the facilitator, so as to streamline the thought processes and to bring the students back to the main learning objectives, whenever required. Students were also encouraged to ask questions to the facilitator during the session. We administered an attitude survey to all the students

who had been a part of the CBL session. They were asked eight questions and were allowed a free response to one question. A 4 point Likert scale questionnaire which contained eight questions were administered (Appendix-C). Multiple Bar Diagrams of the student responses have been shown in [Table/Fig-1]. The other group was taught the same topic in the form of a didactic lecture. Both the groups were evaluated through MCQ exams (after the intervention) and the results of a previous MCQ exam was considered as the baseline (before intervention).

STATISTICAL ANALYSIS

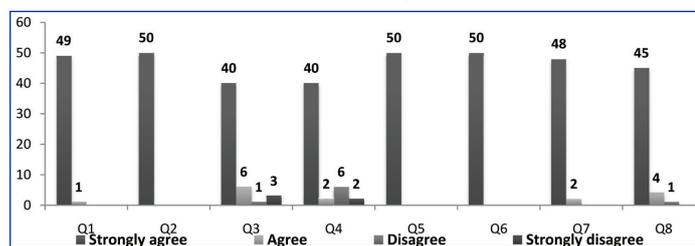
All the results were expressed as mean \pm S.D. Students 't' test was used to compare the continuous variables between the groups. The statistical significance was defined as a p value of <0.05 . The statistical analysis was done by using SPSS, version 14.0

RESULT

The results of the questionnaire are shown in [Table/Fig-1], while the results of the evaluation test have been indicated as mean \pm SD in [Table/Fig-2]. There was a statistically significant ($p < 0.0001$) increase in the test score of the academic performance in the study subjects as compared to that in the controls. All the students felt that the CBL model was a good tool for understanding concepts as compared to the didactic lectures. A majority (98%) of the students rated "agree" on a 4 point Likert scale for "CBL motivating them to study", "more enjoyment with CBL as compared to didactic lectures", "facilitation of an interaction between the staff and students through CBL discussion sessions", "CBL helped in improving the diagnostic skills and lateral thinking. When the future application of this experience was asked, 84% of them felt that this exposure would be of great help in the future also. Overall, the students enjoyed the learning session with the CBL model.

DISCUSSION

CBL seems to be a good method of teaching, on the basis of results of the evaluation test and the questionnaire results, wherein the whole process can be made students-centered. Our results were supported by some of the other medical education researches, which stated that CBL could help in developing an effective learning environment, with the use of specific learning objects [5-7]. It proved to be an interesting concept and it helped the students in improving their academic performances, as it helped in developing interest about the subject, as all the students were curious and attentive and it also motivated them to actively participate, with each one



[Table/Fig-1]: Results of the Questionnaire

	Before intervention	After intervention	p value
Test	20.42 \pm 11.6	36.5 \pm 11	$p < 0.0001$
Control	16 \pm 10.5	26.6 \pm 13	$p < 0.0001$

[Table/Fig-2]: Result of Evaluation test.
 $p < 0.0001$ = very significant.

giving their inputs [8]. It also made the subject easier to learn and it also solidified their understanding of the subject. It helped them in developing logical thinking, clinical reasoning and diagnostic interpretation. This was also observed by other previous workers [9, 10]. The use of case studies in the basic sciences have shown a positive effect on the learning outcomes [11-13].

Care that should be taken during the selection of the case, in that it should reinforce the students' understanding of the key concepts and the mechanistic processes of biochemistry. Books are available, that have clinical cases, but much of this material does not appear to have been specifically written to reinforce the student's understanding of the subject [14, 15]. It seems that CBL might prove to be an interesting exercise and it can help the students in improving their academic performance. During the study, it was observed that a majority of the students enjoyed and embraced the CBL session and the ones who were not a part of it, also showed interest. It helped them in developing logical thinking, clinical reasoning and diagnostic interpretation. The results of the current study and the feedback of the students encouraged us in using CBL as a method of teaching, as it had a lot of positive impact on the students.

CONCLUSION

Research in science education investigates to find out the most effective learning environments to achieve learning objectives. This current study was also done for the above reason and also to compare it with the traditional, lecture style format of the content delivery. It has been felt that CBL could create effective learning environments and thus help in achieving the learning objectives. It has been observed that these days, college graduates are unable to think critically. Clinical case studies encourage active learning and the development of higher order thinking skills. This puts forth a need to promote a student centered active learning with a focus on critical thinking and problem solving in clinical case studies. At the same time, it has been observed that CBL has been found to be beneficial in other subjects for the medical students. In the present study, we observed that the students who were not given CBL, said that they had been motivated to read and that they wanted to be part of such sessions in the future.

APPENDIX-A

Case Based Module

Case Scenario:

A male patient aged 45 years is admitted in the medical unit. He had 2-week history of polyuria, nocturia, polydipsia, polyphagia, weight loss, fatigue, and blurred vision. He also complained of disturbed sleep due to increased frequency of urination in the night. A random glucose test performed 1 day before presentation was 352 mg/dl, urine: glucose present. On admission non-fasting serum glucose 255 mg/dl (N= <180 mg/dl), HbA1c 9.8% (N=4-6.1%).

APPENDIX-B

Specific Learning Objectives

1. What is the case and justify your statement?
2. Is there a correlation between the symptoms and the increased serum glucose level?
3. Explain the situation in a normal individual?
4. Which are the different types of diabetes mellitus?
5. What is diabetic ketoacidosis?
6. What are the long term complications of this disease?
7. What are the management objectives to prevent long term complications?
8. What are the different methods of investigation of hyperglycemia?
9. What is Glycosylated hemoglobin? How important is it in diabetic individuals?

APPENDIX-C

Sumandeep Vidyapeeth, Department of Biochemistry, SBKSMI & RC Piparia, Gujarat, India.

Student Questionnaire: Students perception on Case Based Learning (CBL)

Please give your opinion for each of the following objectives regarding your experience of learning clinical biochemistry using Case Based Learning.

- Q1) In understanding today's topic, CBL session was very useful.
Q2) Clinical case given in today's class was interesting.
Q3) CBL session was very important in terms of development of critical thinking.
Q4) CBL model was useful in future application of knowledge.
Q5) CBL session motivated you to learn biochemistry.
Q6) Promoted meaningful learning than the didactic lecture.
Q7) Role of teacher was very important in CBL session.
Q8) Group discussion during the CBL session was very useful.

Q9) What more do you think can be done?

For all above questions option are given below:

(a)Strongly agree, (b)Agree, (c)disagree, (d)Strongly disagree

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