Case-based learning in endocrine physiology: an approach toward self-directed learning and the development of soft skills in medical students

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Gade S, Chari S. Case-based learning in endocrine physiology: an approach toward self-directed learning and the development of soft skills in medical students. Adv Physiol Educ 37: 356–360, 2013; doi:10.1152/advan.00076.2012.—The Medical Council of India, in the recent Vision 2015 document, recommended curricular reforms for undergraduates. Case-based learning (CBL) is one method where students are motivated toward self-directed learning and to develop analytic and problem-solving skills. An overview of thyroid physiology was given in a didactic lecture. A paper-based case scenario of multinodular goiter was given to phase I Bachelor of Medicine, Bachelor of Surgery students in two sessions. An attitude survey of the students and teachers was done using a Likert scale ranging from strongly disagrees to strongly agree. A pretest and posttest were conducted. The students opined that CBL helped them to better their understanding of a particular topic, gave them better retention of knowledge, helped them to relate clinical conditions to basic sciences, improved soft skills such as communication skills and group dynamics, and promoted a better teacher-student relationship. There was significant improvement in student’s performance when pre- and posttest scores were compared (P = 0.018). Furthermore, faculty members opined that CBL promoted self-study and problem-solving abilities of the students. In conclusion, CBL motivates students toward self-directed learning and to develop analytic and problem-solving skills; thus, CBL could be beneficial for students’ entry into clinical departments and, finally, in managing patients.

case-based learning; self-directed learning; soft skills

MEDICAL COLLEGES in India have traditionally followed a curriculum overloaded with a large amount of knowledge pertaining to basic sciences and clinical disciplines. Once qualified, students are expected to synthesize this information and apply it to the care of patients (11). It has been reported that medical graduates in India generally possesses reasonably sound knowledge of medical science but they are often found deficient in the performance of clinical skills and problem solving, which form the core of clinical competence (14). Compartmentalization among departments, lack of integration, poor coordination between basic sciences and clinical subjects, and adherence to traditional didactic pedagogical methods of instruction could be possible areas for improvement in the existing curriculum. The changing needs of society, advances in scientific knowledge, and innovations in the field have prompted the Medical Council of India to adopt a needs-based curriculum toward self-directed learning for undergraduate medical education in India. The Medical Council of India, in the recent Vision 2015 document, recommended curricular reforms for undergraduates that included foundation courses toward the orientation of students to national health scenarios, learning skills and communication, integration both horizontal and vertical to bridge the gap between theory and practice, and an emphasis on early clinical exposure in the form of introduction of case scenarios for classroom discussion/case-based learning (CBL). This will done as a coordinated effort by preclinical, and clinical faculties, a student-doctor method of clinical training, secondary clinical exposure, electives, skill development and training, and secondary hospital exposure (7).

Our college, which is recognized by the Medical Council of India, also planned to introduce a new teaching-learning method in the form of CBL. It was first implemented in the preclinical phase, and a topic from endocrine physiology was chosen.

Conventionally, teaching of undergraduate students is done with the help of didactic lectures, practicals, a tutorial, and clinics, which are mostly used as passive teaching and learning methods; however, they lack in the development of problem-solving or reasoning skills of the students. Furthermore, there is hardly any involvement of students in the teaching-learning process.

Various alternative methods are being used in many medical colleges to reinforce didactic lectures in endocrine physiology, such as case-stimulated learning (16), problem-based learning (17), patient-centered learning (13), and multiple-format sessions (5).

CBL is one method where students are motivated to learn on their own so as to inculcate the habit of self-learning and integrating knowledge from different subjects to solve problems. It is a small-group method in which both students and faculty members contribute to discussion, learning issues are preidentified, and preparatory readings are assigned while student discussion and guided inquiry around clinical problems are still promoted (12).

This study was undertaken with the following aims and objectives:

1. To motivate students to adopt a problem-solving approach by relating basic science subjects with a clinical scenario and to apply concepts of theory to clinical conditions through self-learning.
2. To develop soft skills such as communication skills and to understand principles of group dynamics.
3. To motivate the peer group to adopt a new teaching-learning methodology.

Thus, the study was mainly focused toward developing problem-solving or reasoning skills among the students.

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METHODS

Phase I Bachelor of Medicine, Bachelor of Surgery (MBBS) students (n = 150) from NKP Salve Institute of Medical Sciences and Research Center (Nagpur, India) were chosen for this study. Permission was obtained from the Institutional Ethics Committee (approval no. 41/2010). A meeting of teachers from the Departments of Physiology, Medicine, and Surgery was arranged, and a case describing multinodular goiter was designed. A facilitator training program was undertaken in the department under the guidance of Chief (Head) of the Medical Education Unit of the institute. The “facilitators” were physiologists, anatomists, and physicians.

Students were informed about the new intervention, and written informed consent was obtained. All steps of CBL were strictly followed. An overview about thyroid gland physiology was given to students in a didactic lecture. Students were divided into multiple batches of 20 students each with a facilitator. A paper-based case scenario of multinodular goiter was given in two sessions 1 wk apart (Appendix A). Students were given enough time to study the case. They discussed the case among themselves. During the first session, students were asked to frame learning objectives based on the cues, and a list of references (from physiology, anatomy, medicine, and surgery) was given to them so as to prepare for the next session. In the next session, more information in the form of investigative reports was provided to the students, and they were asked to solve the problem completely. The teacher present there only facilitated the learning process of each student, streamlined the thought process of the students, and clarified controversy if there was any. An attitude survey of the students was done on nine parameters using five-point Likert scale ranging from strongly disagree to strongly agree. Teacher feedback was obtained on 13 parameters by a Likert scale. To determine the effectiveness of the program, a pretest (before the first session) and posttest (after the second session) were also conducted. The questionnaire designed for the pre- and posttest had 20 multiple-choice questions with a combination of recall type and higher order type based on problem-solving skills and clinical application (Appendix B). The questionnaire had both structured and open-ended questions. A five-point Likert scale was used ranging from strongly disagree to strongly agree to determine the overall rating of the program by students and teachers. A separate questionnaire was developed for teachers with more open-ended questions that could help in the better implementation of CBL in the future. The questionnaire was validated by the Medical Education Faculty of the institute.

Statistical analysis. The objective of the study was to evaluate the impact of the intervention, i.e., CBL, on the students. A 10-point questionnaire was administered to the students before the intervention. Accordingly, a score (out of 10 total) was obtained for each student. The same survey was again repeated after CBL, and student responses were obtained accordingly. The method was implemented by different teachers, who measured the pre- and postintervention impact on their respective tests. Average pre- and postintervention scores of all students were obtained for each teacher. To assess the overall impact of the intervention, a nonparametric Wilcoxon rank-sum test was used. Statistical significance was tested at the 5% level, and the analysis was carried out using the SPSS (version 18.0) package (SPSS).

RESULTS

Of 150 students, 142 students (94.6%) were present for both sessions. There was a significant improvement in student performance when pre- and posttest scores were compared (P = 0.018), which provided evidence as to the effectiveness of CBL (Fig. 1). CBL was highly appreciated by the students (86.7%). The majority of the students (83%) were of the opinion that CBL helped them in self-study and improved their problem-solving ability, and 77.3% of the students felt that CBL helped them in relating knowledge from different subjects (basic sciences with paraclinical and clinical subjects) and in better retention of knowledge. According to 79.2% of the students, the small-group discussions in CBL helped them to improving soft skills such as communication skills, and 69.8% of the students felt that CBL improved the group dynamics. More than 86% of the students felt that CBL would promote a better teacher-student relationship (Fig. 2).

CBL was equally appreciated by faculty members. According to 85% of the teachers, CBL is a better method of teaching and learning, because it promotes self-study and problem-solving abilities of the students. The majority (75%) of teachers felt that CBL would help in improving communication skills, understanding principles of group dynamics, and facilitating a better and healthy teacher-student relationship. When asked for suggestions to make CBL better, faculty members felt that training of teachers should be regularly done. Most teachers (86%) felt that although CBL is a good teaching-learning method, it requires more time, faculty members, and infrastructure. Some teachers (56%) found it difficult to involve shy and less interested students in the group discussion. Only one teacher admitted that it was difficult to just be a facilitator as the teacher knows the subject thoroughly. Faculty members also suggested topics that can be taught by CBL in the next session and showed their willingness to be a faculty member for all CBL sessions in the future, as it promoted them to revisit other subjects because CBL helps in integrating knowledge of the topic from different subjects.

DISCUSSION

Traditionally teaching in physiology has always been through didactic lectures, practicals, and tutorials. There is no single method of teaching that ensures thorough understanding of a topic among students. Our institute is affiliated with a Medical University of the State (Maharashtra University of Health Sciences). We are provided with a curriculum from the university to be taught in a traditional manner, where the major portion of physiology is taught to students with the help of didactic lectures. Lectures are definitely a powerful method of delivering information to a large number of students quickly. However, there are many limitations, such as lectures are a passive method of learning by students and too much informa-
tion is given without application or a problem-solving approach.

There has always been a need for an alternative to the traditional didactic format of lectures in medical education (2, 6). Hence, we thought of adopting a judicious mixture of didactic lectures and CBL sessions as a pilot project in our institute so as to retain the lectures and supplement them with a new teaching learning methodology, which will give a problem-solving approach.

As medical teachers, we provide students a large amount of information, but, at same time, it is necessary to ensure that it should be used to establish and optimize students’ understanding.

What is CBL? By discussing a clinical case related to the topic taught, students evaluated their own understanding of the concept using a high order of cognition. This process encourages active learning and produces a more productive outcome (4, 8).

Why use CBL? (1)
1. To provide students with a relevant opportunity to see theory in practice.
2. To require students to analyze data to reach a conclusion.
3. To develop analytic, communicative, and collaborative skills along with the content knowledge.
4. To provide an opportunity for students to put themselves in the decision maker’s shoes.

The results of this study indicate that the learning of students is significantly enhanced with this new teaching learning methodology, as students were able to answer application-based questions as well. The results of the study also indicate that the assimilation of the knowledge was also improved because discussing a case after the didactic lecture was helpful in reinforcing the key elements of the topic. The retention of knowledge was also better because students were required to study the same topic from all subjects simultaneously so as to integrate the knowledge to solve the given problem.

Similar types of studies have been introduced in some medical colleges in India, and the results have been encouraging (3, 15). An early clinical exposure program consisting of CBL in endocrine physiology in a medical college in India also demonstrated that the majority of students (96.4%) gave an overall rating of the program as good to excellent on a five-point Likert Scale (9).

According to previous study (13) teaching endocrine physiology in a patient-centered learning curriculum, students are better equipped to analyze clinical problems, find and apply appropriate basic science knowledge, and present their patients compared with students from a traditional curriculum.

In a comparative study (12) between problem-based learning and CBL, both students and faculty members preferred the CBL method, as it offers more opportunities for problem-solving skills within a session. In a similar type of study carried out in India, the majority of students reported CBL as a more suitable way of learning compared with problem-based learning and that CBL helped to improve their diagnostic skills and lateral thinking (10).

The teachers who were facilitators in the CBL project admitted that with this exposure to a new teaching-learning process, their knowledge about the new teaching-learning method has increased and they are now ready to experiment with new methods of teaching (theory or practical), assessment, and evaluation. Thus, we recommend the incorporation of this new teaching-learning method for a few systems in physiology, which can be experimented further in other departments.

Summary. The present teaching-learning intervention in the form of CBL was an attempt toward making students responsible for their own learning and narrow down the gaps between students and teachers. Both believe that a proper balance of faculty time and available space would lead to a successful program implementation.

Challenges faced. First, the most difficult task in introducing this new teaching-learning methodology was to change the mindset of the senior teachers to drift them away from the existing curriculum.

Second, as CBL requires teamwork, we were required to convince each and every staff member to seek their cooperation.

Limitations of the study. This study has certain limitations, such as more time and space, infrastructure, and facilitators are required to cover the topic and sometimes it is difficult to convince some faculty members. As the new methodology was introduced to all phase I MBBS students, a control group was missing in the study.

Lessons learned. A greater number of new interventions should be adopted in the teaching-learning process, as it helps
all teachers and students to develop a holistic approach toward the patient, which will be reflected by the health of society in the coming years. Furthermore, the results of this study should be compared with the traditional teaching-learning methodology.

Conclusions. Physiology is a science with an emphasis on homeostatic mechanisms, and its understanding is required to study medicine and pathology. As CBL motivates students toward self-directed learning and to develop analytic and problem-solving skills, it will be beneficial for students’ entry into clinical departments and finally in managing patients successfully.

APPENDIX A: CASE HISTORY

First session. Hema, a 20-yr-old woman, visited the Medical Outpatient Department with a history of swelling in the front of the neck since the last 6 mo. Recently, she also developed complaints of palpitation, excessive sweating, and tremors. There is a significant history of weight loss in last 3 mo, but with no loss of appetite. She does not have any hoarseness of voice or difficulty in swallowing or breathing. On examination, she was told that she is suffering from goiter and advised to seek further investigations. It was further found that there were no signs of exophthalmoses.

Second session. After 1 wk, Hema returned to the doctor with her reports. Upon investigation, it was found that her thyroxine levels were raised and thyroid-stimulating hormone levels were less than normal. A thyroid scan confirmed the diagnosis of multinodular goiter. She was prescribed anti-thyroid drugs and β-blockers and advised to consult a surgeon.

APPENDIX B

Feedback questionnaire on CBL for students. The following is the feedback questionnaire on CBL for students:

1. CBL is a better method of teaching/learning than the conventional one.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

2. CBL promotes self-study and problem-solving abilities of the students.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

3. CBL helps in the recall and application of basic sciences to the given clinical scenario.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

4. CBL helps in better retention of knowledge.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

5. CBL helps in improving communication skills of the students.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree

6. CBL helps in understanding the principles of group dynamics.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree

7. CBL facilitates a better and healthy teacher-student relationship.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

8. CBL gives an opportunity for even staff members with poor teaching skills to be good facilitators.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

9. CBL improves communication skills of the students.
   A. Strongly disagree
   B. Disagree
   C. Neither agree nor disagree
   D. Agree
   E. Strongly agree

10. CBL helps in better retention of knowledge.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

11. CBL helps in understanding the principles of group dynamics.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

12. CBL improves communication skills of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

13. CBL is a better method of teaching/learning than the conventional one.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

15. CBL facilitates a better and healthy teacher-student relationship.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

16. CBL gives an opportunity for even staff members with poor teaching skills to be good facilitators.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

17. CBL helps in the recall and application of basic sciences to the given clinical scenario.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

18. CBL helps in better retention of knowledge.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

19. CBL helps in understanding the principles of group dynamics.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

20. CBL improves communication skills of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

21. CBL is a better method of teaching/learning than the conventional one.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

22. CBL fosters self-study and problem-solving abilities of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

23. CBL facilitates a better and healthy teacher-student relationship.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

24. CBL gives an opportunity for even staff members with poor teaching skills to be good facilitators.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

25. CBL helps in the recall and application of basic sciences to the given clinical scenario.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

26. CBL helps in better retention of knowledge.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

27. CBL helps in understanding the principles of group dynamics.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

28. CBL improves communication skills of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

29. CBL is a better method of teaching/learning than the conventional one.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

30. CBL fosters self-study and problem-solving abilities of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

31. CBL facilitates a better and healthy teacher-student relationship.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

32. CBL gives an opportunity for even staff members with poor teaching skills to be good facilitators.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

33. CBL helps in the recall and application of basic sciences to the given clinical scenario.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

34. CBL helps in better retention of knowledge.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

35. CBL helps in understanding the principles of group dynamics.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

36. CBL improves communication skills of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree

37. CBL is a better method of teaching/learning than the conventional one.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

38. CBL fosters self-study and problem-solving abilities of the students.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

39. CBL facilitates a better and healthy teacher-student relationship.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree

40. CBL gives an opportunity for even staff members with poor teaching skills to be good facilitators.
    A. Strongly disagree
    B. Disagree
    C. Neither agree nor disagree
    D. Agree
    E. Strongly agree
D. Agree
E. Strongly agree
7. CBL deprives students of an opportunity to acquire knowledge from experienced and good teachers.
A. Strongly disagree
B. Disagree
C. Neither agree nor disagree
D. Agree
E. Strongly agree
8. CBL gives opportunity for even staff members with poor teaching skills to be good facilitators.
A. Strongly disagree
B. Disagree
C. Neither agree nor disagree
D. Agree
E. Strongly agree
9. CBL facilitates a better and healthy teacher-student relationship.
A. Strongly disagree
B. Disagree
C. Neither agree nor disagree
D. Agree
E. Strongly agree
10. Give suggestions to make CBL better.
11. Should CBL be included in the timetable as a regular teaching-learning activity (yes/no)?
12. List the disadvantages or drawbacks of CBL, if you found any.
13. Comment on the problems you encountered as a facilitator in CBL.
14. Comment on the problems in implementing CBL in your department.
15. Suggest a few topics that can be taught by CBL in your department.

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DISCLOSURES

No conflicts of interest, financial or otherwise, are declared by the author(s).

AUTHOR CONTRIBUTIONS

Author contributions: S.A.G. and S.N.C. conception and design of research; S.A.G. performed experiments; S.A.G. analyzed data; S.A.G. interpreted results of experiments; S.A.G. drafted manuscript; S.A.G. edited and revised manuscript; S.N.C. approved final version of manuscript.

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