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Case-based learning: A 'Case' for restructuring anatomy education in Indian nursing curriculum

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Abstract:

BACKGROUND: Teaching anatomy in a clinical context can aid students in appreciating how the subject will apply to their future career as nurses as well as in other administrative roles. Anatomy is voluminous, making it difficult to retain the factual information in the long run; therefore, this study primarily focuses on whether case-based learning (CBL) with integrated anatomy learning can help in retention of the information over short as well as long spans of time. It also focuses on how profitable would the students be with this different style of learning, and whether it can facilitate in better understanding of the basic and clinical concepts.

MATERIALS AND METHODS: The current study was conducted in the Nursing College of All India Institute of Medical Sciences, Bhopal, India to integrate CBL and evaluate its effect compared to the highly compartmentalized, didactic lectures among the nursing students. The extent of knowledge retention was analyzed by conducting a series of tests before as well as after CBL intervention. Feedback and suggestions were obtained from the students by using the 5-point Likert scale method.

RESULTS: The post-test scores of the students improved by 21% after the CBL. More than 85% of the students opined that CBL improves critical thinking, team work, self-directed learning, and communication skills.

CONCLUSION: CBL promotes effective short-term retention and facilitates comprehension of key concepts. CBL also plays an important role in improving the professional skills of the students, which otherwise is not taught, and equips them for their future careers.

Keywords:

Anatomy, case-based learning, integration, knowledge retention, nursing education

Introduction

Nursing education has been experiencing significant restructuring in the recent past where traditional/didactic methods of teaching are being slowly replaced by problem-oriented or case-based approaches, especially for understanding the non-clinical subjects. Human anatomy forms one of the foundation stones of health care education. A first-year nursing student is exposed to an enormous amount of detailed information in a very short span of time, which results in the avoidance of conceptual and contextual

treatment of educational material.^[1] Often by the end of the course, students fail to retain the basic principles. It is further compounded by not being able to correlate the knowledge of basic sciences during clinical practice.^[2] Therefore, educators have considered reorganizing the curriculum to develop conceptual approaches that will enable students with better retention and application of knowledge in pathological circumstances, differential diagnosis, and medical practice.^[1] Blooms Taxonomy defines case-based learning (CBL) as a teaching/learning methodology where students apply their knowledge to clinical

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scenarios, which in process stimulates higher cognition. The clinical problems are usually solved in small groups with the help of a facilitator. CBL has been successfully used in medical education in India.^[3]

CBL helps with teaching basic sciences in a pattern that is more consistent with clinical practice, which means not only integrating the basic sciences with one another but also with clinical medicine.^[2] This change in the curriculum was first initiated by McMaster University, in the form of problem-based learning (PBL) over four decades ago, which has been used far and wide in health care education around the globe.^[4] CBL is a derivative form of PBL, where the underlying fundamental principles are almost the same. This PBL approach is andragogical (adult teaching/learning), posing contextualized questions that are based upon real-life problems that may be clinical or nonclinical. As CBL has not been made mandatory by regulatory bodies in medical and nursing education so far, it is not practiced in most of the colleges in our country.^[5]

Therefore, the present study was conceived to introduce CBL to nursing students during their second year, along with the physical examination of a relevant clinical case in the hospital, followed by discussion and reinforcing the basic anatomy learned during the first year.

- To assess the preexisting level of knowledge about respiratory anatomy among second-year nursing undergraduate students.
- To evaluate the effectiveness of Vertical integration and CBL in terms of learning, the long-term retention of knowledge, and clinical application of the respiratory anatomy.

Materials and Methods

Study Design and setting: The 2nd-year B.Sc. Hons Nursing students of All India Institute of Medical Sciences (AIIMS), Bhopal were included for the observational study. Facilitators involved in this study were faculties from Nursing College and Department of Anatomy, AIIMS Bhopal. The existing curriculum practices 60 h of the traditional lecture-based method in the first year.

Study participants and sampling

A total of 54 students were introduced to CBL and integrated anatomy lectures of the respiratory system module in the second year. After taking informed consent, the willing students were divided into groups. They were assessed for their existing knowledge of anatomy by a pre-test that included multiple choice and short answers on respiratory anatomy, respiratory movements, recesses of pleura, and bronchopulmonary segments.

CBL sessions

CBL was conducted in interactive, self-directed, weekly small group sessions over 4 weeks, and the students were provided with study material related to the topic prior to the commencement of these sessions. For session 1, students were introduced to a case scenario where they learned about the medical history and clinical symptoms of the patient. These cases were carefully constructed by respective subject experts and pilot tested with the facilitators. Then, the students examined a clinical case in the ward, under the supervision of a facilitator. Based on the information thus obtained, students discussed the plausible reasons for the symptoms and signs, and the relevant anatomy involved. The teams then discussed the various investigation procedures that will facilitate confirmation of diagnosis. In the third and fourth sessions, facilitators provided the students with findings of investigations. By the end of the session, the respiratory anatomy was summarized, emphasizing the anatomical basis of various clinical symptoms. Each of these sessions lasted for 60 min.

Effectiveness assessment

The effectiveness and satisfaction of integrated CBL were analyzed by tests and questionnaire surveys. Students were tested for their knowledge retention with a post-test (immediately after the session) and follow-up post-tests after 4 weeks and 2 years. Feedback and suggestions on the design and impact of integrated CBL were collected from the students by using the Perceived Benefit Questionnaire.

Statistical methods

The data were entered in Microsoft Excel for Windows, and the analysis was done using SPSS Version 16.0 software (SPSS Inc., Chicago, IL). Descriptive statistics such as mean, standard deviation (SD), and minimum and maximum were calculated for pre-test, post-test, and post-test retention scores. We used repeated-measures analysis to test whether the test scores change over time. Paired *t* test was used to compare the average scores between each of the two time points, and the adjustment for multiple comparisons was done using Bonferroni method. For all the analyses, *P* < 0.05 was taken for statistical significance.

Ethical consideration

Prior to data collection and analysis, ethical clearance for this study was obtained from RRB and IHEC of AIIMS, Bhopal (IHEC/LOP/2016/IM0085).

Results

Fifty-four nursing students participated in the integrated CBL sessions. Out of the 54 students, 52 took pre-test, 46 took immediate post-test, and 51 had taken follow-up

post-tests at 4 weeks and 2 years. The number of students who took all three tests was 42; their mean (SD) pre-test score was 7.71 (2.38), the post-test score was 10.96 (2.14), and the post-test retention score was 10.06 (1.78) [Table 1].

A statistically significant increase in scores was observed for students who had taken pre-test and post-test (n = 44) and also for those who had taken only pre-test and follow-up post-test (n = 49) as 3.23 and 2.27, respectively ($P < 0.001$). However, there was no significant difference in scores between students who had both post-test and the follow-up post-test scores (post-test: 11.02 vs. post-test retention: 10.20) ($P = 0.087$) [Table 1].

Better scores obtained by the students in the post-tests (10.96 ± 2.14) as when compared to the mean score obtained during the 1st year didactic teaching (7.29 ± 2.09) as well as the pre-test score for respiratory anatomy (7.71 ± 2.38) demonstrates that CBL with integrated anatomy lectures proved to be more impactful, coherent, knowledgeable, and easy to recall for the students.

Students' perception of the CBL and their skills acquisition are shown in Table 2. Overall, the students agreed that CBL is an interesting way of learning anatomy.

We present some of the feedback from the students. "CBL gave me more knowledge regarding the respiratory system. It gave me an idea of how to connect the symptoms to a disease condition. I hope we have more CBL sessions in the next year." The majority of the students felt it was very apt. Another student said, "I want to study anatomy in hospital base with relevance for nursing. Actually, at first, I could not even understand what it is related to. But after discussion, Verbatim response of the study participant. Most students felt that it was time-consuming. Some students requested that cardiac and gastrointestinal anatomy be taught in the CBL format.

Discussion

Datta and Ray in their study in 2016 found that post-test scores were 12% higher after CBL sessions than with didactic teaching.^[5] In a similar study among occupational therapy students, Parmar *et al.*^[6] showed that integrated

CBL demonstrated sustained improvement in the performance of students and long-term retention of factual information necessary for clinical practice. In our study, we observed a 21% better performance after the CBL. This reinforces that CBL is more beneficial to students in understanding the concepts and facilitates long-term retention of anatomical facts.

A pilot study conducted by Deonandan *et al.* on CBL among global health undergraduate students had described CBL as time-consuming and expensive and considers it not applicable to all the topics but rather to selective topics. Besides these, as CBL involves teamwork, students responded about the poor leadership, lack of participation and discussion, and language barrier as some of the lacunae in this approach.^[4] Interestingly, Crowther *et al.*^[7] concluded in their study among veterinary students that even when CBL is delivered within the constraints of a large group, it was beneficial to the students. On the contrary, a study conducted among the 1st-year MBBS students had 51% of students in support of the CBL as it helped them strengthen their clinical concepts, and 87% of students credit it to help them perform better in their clinical cases. This study had also stated that CBL was time-consuming and not all students being able to participate fairly in the discussions.^[8] The present study also brought out that though the process was time-consuming, the benefits outweighed the discomforts.

Nathaniel *et al.*,^[9] in a self-directed clinical case learning (SDCL) module followed for neuroscience, opine that it inspired students to set higher standards for themselves as the interactive sessions provide the platform to ask themselves incisive questions, to identify their biases and empowering them as intelligent contributors to their own learning processes. Our students' attitude toward the intervention was also perceived positively; 86% of students responded to it as a highly recommended method of learning.

Srinivasan *et al.*^[10] in their study, which involved the whole curriculum being switched from PBL to CBL for 1st, 2nd, and 3rd-year MBBS students, observed that though they received mixed responses, the majority of the faculty and learners supported CBL over PBL. According to Rafique, in his paper on the importance of vertical integration and teaching assessment of physiological concepts,

Table 1: The average pre-test, post-test, and post-test retention scores with the standard deviation and the overall and pairwise comparison significance

Time Point	n	mean (SD)	Min	Max	Overall significance [§] P value	Pairwise comparison* P value
Pre-test (A)	52	7.71 (2.38)	2	12	<0.001	A vs. B: <0.001
Post-test (B)	46	10.96 (2.14)	6	15		A vs. C: <0.001
Post-test retention (C)	51	10.06 (1.78)	6	13		B vs. C: 0.087

[§]Repeated-measures analysis. *Adjustment for multiple comparisons: Bonferroni

Table 2: Perceived outcomes of case-based learning

Perceived outcomes of case-based learning	% of positive responses
Relevance of topic	98.1
Integration of basic and clinical knowledge	96.2
Application of basic knowledge in clinical scenario	96.2
Ease of comprehension	88.7
Clinical case design	84.9
Learning Skills and attitude toward CBL	
Critical thinking	90.4
Collaboration	94
Problem-solving	90.4
Self-study	80.8
Respecting peers	76.9
Responsibility	82.7
Facilitating active learning	86.9
Better communication	88.4
Teamwork	92.3

observed that 85% of the students reacted to teaching physiological concepts in integration with case studies as a better approach as compared to traditional teaching; 99% indicated that vertical integration makes learning and understanding easier.^[11] In our study, we have not only introduced CBL but also as vertical integration during their second year of nursing course, which was found to be extremely beneficial to the students. Through this study, it is inferred that though anatomy was taught in the first year, students had better assimilation of knowledge through the integrated CBL intervention in remembering key concepts essential for future nursing practice.

Generation Z or iGeneration students are digitally advanced and often live in their own virtual world. Empathy and care, the hallmark of the nursing profession, are found lacking in the present scenario. In the study by Kantar and Massouh, aimed at identifying professional skills that are gained by CBL instruction, they conclude with the inevitable need to explore the role of instruction in developing ineffable professional skills in nursing students.^[12] The feedback from the present study reinforces that CBL provides an opportunity for development of interpersonal relationships, team work, communication, and professional skills.

Limitation and recommendation

The study involved only one batch of 60 nursing students, which is a small sample size. CBL should be incorporated not only for anatomy but also for other basic subjects to facilitate better understanding, long-term retention, and clinical application of knowledge.

Conclusion

The aim of this study was to identify the effectiveness of CBL-integrated anatomy among nursing students and to determine the extent of knowledge retention over

short and long periods of time. The overall response of students toward integrated CBL was found to be highly satisfactory. The first-year scores and the pre-test in the second year before the CBL intervention showed no difference. The significant difference in the mean scores of pre-test to that of immediate post-test and follow-up post-test conducted after 4 weeks implies that CBL promotes effective short-term retention and facilitates comprehension of key concepts. CBL also plays an important role in improving the professional skills of the students, which otherwise is not taught, and equips them for their future careers.

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Conflicts of interest

There are no conflicts of interest.

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