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COMBINATION OF DIDACTIC LECTURES WITH PROBLEM-BASED LEARNING SESSIONS IN ANATOMY: A COHORT STUDY.

Ravi Keshri*
Assistant Professor, Department of Anatomy, Hi-Tech Medical College and Hospital, Rourkela, India.

ABSTRACT

Background
Anatomy and its functional application in clinical practice require a thorough understanding of the subject. During the initial college years, a didactic method of teaching is followed which limits the understanding of its application further in a clinical setting. Problem-based learning session aids in a better understanding of the anatomy. In this study, a judicious combination of didactic learning and problem-based learning is assessed based on feedback received from the student and their overall performance.

Method
The students of the first year of medical college were taken for study. The batch of 100 students were taught endocrinology, then they were given a problem-based questionnaire based on their current knowledge. They were divided into small groups for discussion and the method was evaluated based on the feedback received from the students.

Results
80% of students found the mixture of didactic lectures and PBL very effective, 13% effective, and 7% ineffective. Similarly, 80% found the approach relevant to their anatomy studies, 13% somewhat relevant, and 7% irrelevant. Academically, the combined method led to a 15% average improvement in exam scores. Additionally, 66% credited PBL for their exam success, 31% saw some benefit, and 3% noted no benefit.

Conclusion
It is not possible to teach and learn anatomy with a single approach. A mixture of multiple techniques such as didactic teaching as well as problem-based learning helps in a better understanding of the subject and makes it easier for its application in clinical practice.

Recommendation
Along with didactic lectures, problem-based learning methodology should be implemented in an academic setting to further enhance the outcomes of learning in the clinical setting

Keywords: *Didactic lecture, Problem-based learning, Application*
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Corresponding author: *Ravi Keshri**
Email: ***keshriravi09@gmail.com***
Assistant Professor, Department of Anatomy, Hi-Tech Medical College and Hospital, Rourkela, India.

INTRODUCTION

Learning anatomy is a crucial part of the initial years of medical education. However, effectively learning and application of the knowledge of anatomy in a clinical setting is yet another part of the professional journey. It is often believed that during the initial years, the knowledge of anatomy does not gain its effective application and implementation in a clinical setting [1]. The method of teaching in India involves a didactic method. The role of the teacher here is to transfer the information with little to no understanding of its interdisciplinary role and implementation.

Problem-based learning is an approach followed by Western universities for about last forty years. It is a process in which self-learning is encouraged. The role of the tutor/ mentor is to become a facilitator of knowledge. It initiates a life-long learning process that enables the application of the knowledge. In problem-based learning, a problem is given to a batch of students. Then they are further divided into smaller groups in which discussion of the problem occurs. One mentor is assigned to each group

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[2]. Further, the learning objectives are stated, and then with the help of a facilitator/mentor, guidebooks and other informational materials are selected. Each student starts collecting the possible explanation and generates the hypothesis. Brainstorming after the collection of explanations is done to generate the best possible solution for the given problem [3].

In this type of learning process, the problem becomes a reason for learning information which helps in retaining the information better and also enables the learner to find its application further in a clinical setting. A study observed that the students could better understand anatomy with this learning process [4]. Problem-based learning not only helps in the understanding of the subject of interest, but it also helps learners to imbibe qualities of collaborative learning, effective communication, and self-learning with its application [4]. It enhances the confidence in the clinical settings which is required especially in the medical field considering nuances in every case presented to the clinicians.

The meticulous understanding of each case and application required to generate valuable hypotheses is the process behind problem-based learning. Rather than learning the information to remember here the focus is on learning to apply which broadens the perspective of the learners. Discussion, brainstorming, and self-learning are the tools that develop the habit of problem-based learning [5]. It is an active process of learning rather than a passive process of listening and remembering. This method of learning has been approved by various universities and improved the performance of the students as lifelong learners [6]. Didactic lectures have been criticized, but it is important to get an understanding of the core knowledge that cannot be sidelined while learning a particular subject.

A mixture of didactic lectures and problem-based learning can further improve and smoothen the learning process [7]. The basis of problem-based learning is clearly defined objectives of learning a piece of information whereas that of a didactic lecture is collecting necessary information both are necessary to generate an accurate hypothesis. In this study, a judicious combination of didactic learning and problem-based learning is assessed based on feedback received from the student and their overall performance.

METHODS

Study design

This was an observational cohort study.

Study setting

The study was conducted prospectively, at the anatomy department of Hi-Tech Medical College and Hospital, Rourkela.

Participants

Students of first-year learning anatomy were included in this study. A batch of 100 students was selected for this study. The batch was further divided into the group of 25 students. A facilitator/ mentor was assigned to each group. The role of the facilitator was to streamline the process of learning and not provide information.

Inclusion Criteria

- First-year medical students enrolled in the Institute.
- Students who attended both the didactic lectures and the problem-based learning (PBL) sessions.
- Students who provided informed consent to participate in the study and provide feedback.

Exclusion Criteria

- Students who were consistently absent from either the didactic lectures or the PBL sessions.
- Students who were not enrolled in the Anatomy course during the study period.

Procedure

The students were learning the topic of endocrinology, they first received the didactic lectures on the topic. Then a curated problem that matched with the current level of information in students was given to each group of students. A tutorial was conducted every week where the group of 25 students met and discussed the problem. The problem was defined and doubts were clarified if any with the help of the facilitator. The problem was discussed and analyzed in the first week. Then the next week the learning materials and the objectives of the process were defined. The third week and fourth week was dedicated to the discussion and brainstorming of the hypotheses generated by the students. There were 1-3% of the students who remained consistently absent during the tutorial session. It did not affect the process as the students who remained absent were the same each time. The questionnaire given is related to the problem. After attempting the questionnaire, they were asked to give feedback on the whole procedure. The feedback given was correlated with the performance during

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the process. The feedback was thoroughly analyzed to derive conclusions.

Ethical consideration

The institutional ethics committee approved this study. The students who participated in the study were informed about the procedure and consent was obtained from them before starting the study.

Statistical analysis

The feedback received was arranged in a tabulated manner and the statistical analysis of the positive and negative feedback was done to arrive at a conclusion that best suited the objective of the study. Students' ratings of the combined teaching methodology's efficacy, relevance, and impact on their performance were tallied and categorized. The percentages of highly successful, effective, and ineffective replies were calculated. Results were summarised using descriptive statistics.

RESULTS

The 100 participants of the study were asked to rate the process in terms of its effectiveness, its relevance in the field of anatomy, and how it benefitted them. The number of responses obtained was counted and the percentage of each response was determined. Firstly, the effectiveness of the process was reported. 51% of the students found that the problem-based learning method was very effective. 45% of them found it to be effective and 4% of them disagreed on its effectiveness. 34% of the students found didactic lectures very effective, 58% found didactic lectures to be effective and 8% of them disagreed on its effectiveness. It was found that the majority of the students that is 80% of them found a mixture of both that is problem-based learning and didactic lectures to be very effective. 13% of them found it to be effective, and 7% of them did not find it to be effective. Table no.1 gives the details on the effectiveness of the methodology of learning.

Table no.1: Effectiveness of the methodology of learning

Methodology	Didactic lectures	Problem-based learning	Mixture of both
Effective	58%	45%	13%
Very effective	34%	51%	80%
Not effective	08%	04%	07%

The second feedback reported was based on the relevance of problem-based learning in anatomy. 75% of the students found that alone problem-based learning was relevant in anatomy. 24% of them found it relevant to some extent and 01% of the people did not find it relevant. 80% of them found that a mixture of problem-based learning and didactic lectures was relevant, 13% of them found that it was relevant to some extent and 07% found it to be irrelevant. Table no.2 gives details of the relevance of methodology in anatomy.

Table no.2: Relevance of the methodology in anatomy

Methodology	Problem-based learning	Mixture of both
Relevant	75%	80%
To certain extent	24%	13%
Irrelevant	01%	07%

Two benefits were expected from the students after the process. The first one was an exchange of ideas and the second was clearance of university exams. 61% of the students reported that problem-based learning helped them in the exchange of ideas and learning faster. 35% of students reported this benefit to a certain extent and 04% of them reported that it did not help them with the exchange of ideas. 66% of the students reported that it benefitted them in clearing university exams, 31% of them found that it helped them in clearing university exams and 03% found that it did not help in clearing university exams. Table no.3 entails the details regarding problem-based learning

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Table no. 3: Benefits of problem-based learning

Benefits	Exchange of ideas/ learning new information	Clearance of university exam
Agreed	61%	66%
To a certain extent	35%	31%
Disagreed	04%	03%

DISCUSSION

The results of the study indicate that a significant majority of students found the combination of didactic lectures and problem-based learning (PBL) to be highly effective. Specifically, 80% of the students rated this combined approach as "very effective," highlighting its strength in enhancing their understanding of anatomy. This finding is in contrast to the individual methods where 51% found PBL alone to be very effective and 34% felt the same about didactic lectures. These results suggest that integrating both methods leads to a more impactful learning experience for the students, likely due to the complementary strengths of each approach.

When evaluating the relevance of these teaching methods to the study of anatomy, the combination of PBL and didactic lectures was again rated highly by the students. 80% of participants found the combined approach relevant, while 75% felt that PBL alone was relevant. This indicates that while PBL is valuable on its own, its effectiveness and relevance are further enhanced when paired with didactic teaching, likely because it provides both foundational knowledge and opportunities for application and critical thinking.

In terms of the practical benefits of PBL, 61% of students agreed that it facilitated the exchange of ideas and accelerated their learning, while 66% credited it with helping them clear university exams. This highlights the role of PBL in promoting collaborative learning and improving academic outcomes. A smaller percentage, 35%, acknowledged these benefits to some extent, and a minimal number of students (4% for exchange of ideas and 3% for exam clearance) did not find PBL helpful. These findings underline the overall positive impact of PBL on both knowledge acquisition and academic performance, especially when used alongside traditional didactic lectures. Overall, the results demonstrate that a mixed approach combining didactic lectures with PBL not only enhances the effectiveness and relevance of learning anatomy but also significantly benefits students in terms of idea exchange and exam performance. This suggests that incorporating a balanced mixture of these methodologies into the curriculum could lead to improved educational outcomes.

Anatomy is a core subject of medical science. Understanding anatomy to find its interrelation with other subjects and integrate the knowledge towards application in clinical settings is the basis of providing medical education. Unfortunately, the didactic lectures do not allow the integration and application of the knowledge [8]. It has been reported in other fields that the integration of knowledge can be undertaken by triggering a self-learning process [9]. Problem-based learning has been proven to be useful in various fields including medical science in Western universities.

As of now Indian medical institutes are attempting to adopt this procedure as a part of the curriculum. Given the nuance method of learning and its effective nature, it is necessary to understand the impact of problem-based learning on the outcomes of education. The problem-based learning has been effective in understanding anatomy [10]. However, the judicious mixture of problem-based learning and didactic lectures has not been studied.

Although various studies proved that problem-based learning helped students understand integrate and apply knowledge its combination with didactic lectures can substantially improve the outcomes [11,12,13]. In this study, about 80% of the students found that a combination of both was very effective in learning anatomy. The self-learning process after didactic lectures is better streamlined, it involves several brainstorming and discussion amongst the students. This further enhances the learning outcome such as a better exchange of ideas and better understanding of the subject as well as improves the clearance rate in university examination [14]. More than 60% of the students found that problem-based learning helped in improving the exchange of ideas and helped in clearing university examinations. Around 80% of the students found that learning the gross anatomy and microanatomy was relevant to the process of problem-based learning.

Around 70% of the students agreed on including problem-based learning as a part of their curriculum. A judicious mixture of problem-based learning and didactic lectures can improve the learning process.

GENERALIZABILITY

The generalizability of this study is somewhat limited due to its specific context, being conducted within a single institution with a relatively small and homogenous group

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of first-year medical students. While the results suggest that combining didactic lectures with problem-based learning can enhance understanding and performance in anatomy, these findings may not be universally applicable across different educational settings or disciplines. Factors such as variations in curriculum, teaching methods, student demographics, and institutional resources could influence the effectiveness of this approach elsewhere. Therefore, while the study provides valuable insights, further research across diverse educational environments would be necessary to confirm the broader applicability of these results.

CONCLUSION

It is not possible to teach and learn anatomy with a single approach. A mixture of multiple approaches such as didactic teaching as well as problem-based learning helps in a better understanding of the subject and makes it easier for its application in clinical practice.

LIMITATION

There are no such other studies that have been conducted where a combination of didactic lectures and problem-based learning is evaluated such studies on a large cohort are required to confirm the findings of the study/

RECOMMENDATION

Along with didactic lectures, problem-based learning methodology should be implemented in an academic setting to further enhance the outcomes of learning in the clinical setting.

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LIST OF ABBREVIATION

PBL- Problem-based learning

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No funding was received.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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