

SELF-ASSESSMENT OF CRITICAL THINKING AND ACTIVE LEARNING IN UNDERGRADUATE DENTAL STUDENTS USING FLIPPED CLASSROOM TECHNIQUE AND JOURNAL CLUBS

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ABSTRACT

Objective: To self-assess critical thinking and active learning using techniques of flipped classroom and journal club among undergraduate dental students of Dental College HITEC-IMS.

Design: Cross-sectional descriptive study.

Place and Duration of Study: Dental College HITEC-IMS, 06 months.

Materials and Methods: Study participants included first year students. Flipped classroom strategy was adopted for pre-decided topics in classes of physiology and journal clubs were also introduced in all these sessions. Students discussed and presented the topics given to them in the form of power point presentations which were judged by the faculty. Students evaluated their critical thinking and active learning at the beginning and conclusion of the study using a validated questionnaire. The data was analyzed using frequencies/percentages and comparison was done (pre and post test) to see improvement in active learning and critical thinking using SPSS. The paired student t test was used for the pre- and post-testing, and a p-value of 0.05 was regarded as statistically significant.

Results: A total of 46 students with mean age(years) 19 ± 1 participated, out of which 14% were males and 86% were females. A 14-item questionnaire showed an improvement in active learning by setting learning objectives (80%) and utilizing multiple learning strategies (87%). Comprehension of discussion and self-directed learning improved to 87%. Critical thinking improved with hypothesis generation along with group performance (87%) and analyzation of knowledge using concepts (85%). Reflection on action improved learning to 80% in our settings. The mean values for pre-test and post-test samples were 2.5 ± 0.35 and 2.7 ± 0.43 respectively. Using a paired student t test, results with a p value of 0.03 were found to be statistically significant.

Conclusion: The results of our study reveal that combining journal club and flipped classroom techniques strengths the evidence-based inquiry among undergraduate dental students, enhances their critical thinking and active learning. We recommend to incorporate these teaching learning strategies as permanent part of the curriculum.

Key words: *active learning, critical thinking, journal club, flipped classroom*

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INTRODUCTION

In the modern era of evolving medical education, novel teaching and learning strategies have been adopted worldwide. The millennial learners are moving at a fast pace and no longer relish the old, boring and traditional teaching styles incorporating the lectures¹. Teaching strategies are now molded so that the complex subjects under the tree of health sciences can be delivered with ease and effectiveness. As evident from research and experience, traditional didactic lectures do not assist students to acquire cognitive skills and active learning abilities

that are essential for educating future health professionals. Students prefer interactive learning strategies to improve their overall performance². Many of the institutions are now shifting from traditional didactic to interactive pedagogies³. Because of the recent COVID-19 pandemic, teaching approaches have been transformed, thanks to virtual classrooms. In the similar context, flipped classroom and journal clubs have gained immense appreciation for incorporating active learning and critical thinking abilities^{4,5}. The teaching methods employed in Pakistan's medical education sector are antiquated. Poor curriculum design and a lack of research has exacerbated the problem⁶.

Flipped classroom is innovative interactive learning technique that improves cognitive learning instead of passive learning. This technique helps the students learn at their own pace and self-assess their active learning in phases. Active learning can also be imparted through journals clubs for practical understanding of the topic especially in healthcare professions.

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Journal clubs help in improvement of knowledge, presentation skills, critical thinking and self-directed learning process. It also promotes a positive attitude of students towards research at undergraduate level⁷.

Despite the fact that medical education is evolving at a fast pace, many institutions across Pakistan still lacks the instructional techniques to keep up with these developments⁸. More importantly, many institutions are only beginning to implement innovative teaching methods. Tech-savvy students of current generation must be introduced to these novel concepts and learning pedagogies in order to keep up with the World Health Organization's list of "Five Star Physicians" essential competencies. Therefore, we have implemented the flipped classroom and journal club technique to assess their active learning and critical thinking using Self-Assessment Scale on Active Learning and Critical Thinking (SSACT).

METHODOLOGY

Over a 6-month period, a cross-sectional descriptive study was conducted on the first-year BDS students at Dental College HITEC-IMS. The Institutional Review Board (IRB) of the Dental College HITEC-IMS, Taxila granted ethical approval. All 1st year BDS students (n=46) participated in this study.

The study was conducted during Physiology sessions. The two sessions were implemented in the 1st block which spanned over the period of three months. Traditional system of curriculum is followed at dental college HITEC-IMS. The important topics selected for these sessions were related to the content delivered i.e., myasthenia gravis and vitamin B12 deficiency. The sub topics included were; causes, signs and symptoms, pathophysiology, lab investigations, treatment and critical analysis of the article. The students were informed of the learning objectives a week before the session. They were given pre-reading material in the form of lecture notes, videos and journal club articles which were uploaded on the google classroom. The faculty guided the students for preparing these sessions. The students were split into five groups of ten students each. Each group was given a different topic to prepare. On the day, the students came prepared with the material provided to them. They discussed the topic with particular emphasis on active learning and critical thinking process followed by PowerPoint presentations on the next day. The group presenters were selected randomly.

Each group was given a time of 15 minutes to present their topic which was followed by question-and-answer session among students and faculty. These presentations were judged by a senior faculty panel consisting of 6 members. The Judgment criteria was adopted from University of Texas, School of Undergraduate Studies available on their website⁹.

DATA AND STATYSTICAL ANALYSIS

After obtaining informed consent, questionnaires were provided to the students at the start of the study (pre-test) and after completion of two sessions (post-test). The students filled Self-Assessment Scale on Active Learning and Critical Thinking (SSACT)¹⁰ questionnaire under the direct supervision of one of the co-authors to self-assess the improvement in active learning and enhanced critical thinking. The questionnaire consisted of 14 items related to active learning and critical thinking. The 5-point Likert scale was converted to a 3-point Likert scale for ease of data analyses¹¹. The responses were classified as 1 = strongly disagree, 2 = neutral and 3 = strongly agree. Data was analyzed using SPSS version 26. The frequency and percentage-based quantitative data were analyzed using descriptive statistics. Pre and post sample testing was done using paired sample statistics where mean values are given as mean \pm SD and statistical significance for the paired student t test was set at p 0.05.

RESULTS

A student cohort of (n=46) participated in study. The age range of Students was from 18-21 years with average of 19 (14% males and 86% females) and they belonged to similar demographic background i.e., Punjab. The Results of the two components are:

1. **Active learning:** It was easy for the students to comprehend the summary of the discussion after the intervention which was 76% initially and increased to 87%, shown in table 1. Results of post-test showed that 80.4% of students were now able to set their own learning objectives during these sessions efficiently, when compared to the start of the study 58.7%. Improvement seen in management of independent study and team work was 67.4% post-test. The reflection of learning process improved from 67.4% to 80.4% pre and post-test respectively. The majority of students agreed that they could study independently using various forms of the flipped classroom and journal club technique, however, there was no noticeable statistical difference between the pre- and post-testing periods. (table 1).
2. **Critical thinking:** The most notable finding was improvement in group performance from 76.1% in pre-test to 87% in post-test shown in table 1. A marked improvement of thirty percent was seen in hypothesis generation by the students while discussing any problem. In subsequent sessions, the application of previous knowledge from independent study and analyzation of knowledge utilizing ideas showed considerable improvement from 69% to 84%. Students were able to formulate scenario-based questions which improved from 63% to 76.1% before and

CAPSULE SUMMARY

Combination of journal clubs and the flipped classroom teaching method as teaching-learning techniques in undergraduate dental program improved the learning and cognitive capacities of the students making them more critical thinkers and active learners.

Table 1: Frequencies and Percentages on SSACT scales along with areas identified for both sessions.

Areas identified		Frequencies					
		Pre-test			Post-test		
		Strongly agree	Neutral	Strongly disagree	Strongly agree	Neutral	Strongly disagree
Self-Assessment response on scale of Active Learning							
1.	Setting my own learning objectives	27 (58.7%)	14 (30.4%)	5 (10.9%)	37 (80.4%)	5 (10.9%)	4 (8.7%)
2.	Utilizing multiple learning strategies for independent learning	40 (87.0%)	2 (4.3%)	4 (8.7%)	40 (87.0%)	4 (8.7%)	2 (4.3%)
3.	Comprehending the summary of discussion	35 (76.1%)	8 (17.4%)	3 (6.5%)	40 (87.0%)	5 (10.9%)	1 (2.2%)
4.	Effective management of independent study	26 (56.5%)	11 (23.9%)	9 (19.6%)	31 (67.4%)	10 (21.7%)	5 (10.9%)
5.	Enhance team work	16 (34.8%)	22 (47.8%)	8 (17.4%)	31 (67.4%)	11 (23.9%)	4 (8.7%)
6.	Reflection of my learning process	31 (67.4%)	11 (23.9%)	4 (8.7%)	37 (80.4%)	8 (17.4%)	1 (2.2%)
Self-Assessment response on scale of Critical Thinking							
7.	Formulation of scenario-based questions	29 (63.0%)	8 (17.4%)	9 (19.6%)	35 (76.1%)	6 (13.0%)	5 (10.9%)
8.	Communication of ideas	28 (60.9%)	15 (32.6%)	3 (6.5%)	35 (76.1%)	9 (19.6%)	2 (4.3%)
9.	Performance in group	35 (76.1%)	8 (17.4%)	3 (6.5%)	40 (87.0%)	4 (8.7%)	2 (4.3%)
10.	Application of previous knowledge from independent study	32 (69.6%)	9 (19.6%)	5 (10.9%)	38 (82.6%)	5 (10.9%)	3 (6.5%)
11.	Analyzation of knowledge using concepts	32 (69.6%)	10 (21.7%)	4 (8.7%)	39 (84.8%)	5 (10.9%)	2 (4.3%)
12.	Linking new and previous knowledge	35 (76.1%)	6 (13.0%)	5 (10.9%)	35 (76.1%)	10 (21.7%)	1 (2.2%)
13.	Explanation in own words	36 (78.3%)	8 (17.4%)	2 (4.3%)	35 (76.1%)	9 (19.6%)	2 (4.3%)
14.	Hypothesis generation to discuss a problem	18 (39.1%)	18 (39.1%)	10 (21.7%)	32 (69.6%)	9 (19.6%)	5 (10.9%)

after the test respectively. No statistically significant results were obtained from linking new and old knowledge or explanation in their own words (table 1).

The mean values for pre-test and post-test samples were 2.5 ± 0.35 and 2.7 ± 0.43 respectively. Statistically significant results were obtained using paired student t test with the P value of 0.03

DISCUSSION

The findings of our study suggest that flipped classroom and journal club is a highly effective method for teaching physiology. These techniques were introduced as a class activity, which the students enjoy in comparison with traditional lectures. The sessions of flipped classroom and journal club led to noticeably greater grasp of the instructional objectives as shown in table

1 and had already been proven in various studies¹². Moreover, our study shows it has potential to improve students' academic performance by increasing disciplinary understanding and satisfaction as they achieve their own preset learning objectives in the end.

Results demonstrated a considerable value in favor of group discussions and topic comprehension (table 1). Through resource and instructor access, it personalizes learning, fosters higher-order thinking through problem-solving, and involves students in cooperative learning through peer groups. Similar results were obtained showing that environments that promote group learning seem to have more consistently positive student learning patterns¹³.

Our study's use of journal clubs in conjunction with flipped classroom strategies is one of its strengths. This assisted the

students in understanding the value of research which is also proven in studies conducted worldwide¹⁴. Students found it fascinating to connect their academic knowledge with several case studies in the journal club article. This made it easier for students to comprehend how medical information is used. An important finding of our study was increased ability of students in comprehending the summary of discussion in these sessions, promoting active learning. This positive attitude helps in better engagement, question generation and learning motivation as proven in various studies¹⁵. Moreover, students were able to reflect their own learning process. Students' critical thinking skills can grow through the adoption of a reflective practice, evidence of which is shown in various studies¹⁶.

For items gauging critical thinking one of the highlights of our results showed, scenario-based question formulation or problem solving became easy for the students as shown in table 1. Our study shows that students were now able to generate a hypothesis to solve a problem and were motivated to think and assess the cases provided in the journal club articles critically as seen in previous studies done on postgraduate medical and dental students¹⁷. Researches have proven that journal clubs help students by improving their cognitive capacity and clinical application of knowledge. It also allows students to have in-depth discussions about a case or an illness¹⁸. Insignificant results were obtained in area of linking new and old knowledge (table 1), which improves as the learning of the students will progress in subsequent years of basic and clinical sciences training^{16,17,18}.

Comparison of pre and posttest results showed that all the elements contributing to active learning and critical thinking had significantly improved using combined flip classroom and journal club techniques. Individually, these strategies have engaged the millennial learners in learning effectively¹⁹ and improved the learning process²⁰. These techniques provide the ideal setting for teaching evidence-based medicine and concentrate on critically reviewing recent literature and applying it to patient care²¹ in undergraduate settings.

CONCLUSION

The results of our study reveal that combining journal club and flipped classroom techniques strengthens the evidence-based inquiry among undergraduate dental students, enhances their critical thinking and active learning. We recommend to incorporate these teaching learning strategies as permanent part of the curriculum.

LIMITATIONS

The outcome of the study could not be generalized because it was limited to a single educational environment. These parameters must be taken into account if this finding is to be applied in other educational contexts. Another obstacle that affects student learning and assessment is faculty turnover.

AUTHORS' CONTRIBUTION

Maryam Ahmad	Conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the Article
Sadaf Mumtaz	Conception and design, Critical revision
Ambreen Gul	Critical revision
Qudsia Iqbal	Acquisition of data
Ayesha Jabeen	Acquisition of data

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