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Original Article

Reinforcement of learning in the subject of Pathology for Phase II MBBS students using Quiz as a Teaching-Learning modality in a Government Medical College in Assam

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ABSTRACT

Background: Pathology bridges basic sciences with clinical practice but often challenges retention and application. Quizzes promote active learning, reinforce key concepts, and support self-assessment. Integration of clinical cases add relevance, provide concept clarity and improve practical understanding for long term retention.

Objectives: The study objectives were to implement quizzes as reinforcement learning tool in the subject of Pathology for Phase II MBBS students & its impact as a T-L modality

Methods: Sensitized 102 students were divided into Study group & Control group using odd /even numbers of 51 students in each group. Study group was sent for quiz on one completed system of Pathology with ten teams and control group was sent for self-study. There was crossover on next completed system with total MCQ based two pretests, two posttests and four rounds in each quiz. Online student feedback was collected to know their views. Data was analyzed using paired t test to assess effectiveness.

Results: Students who underwent quiz programme performed better in post-test (mean difference = 2.01) than the self-study group (mean difference=0.41) and was found statistically significant. In feedback perception analysis, 86% commented it was a good and helpful initiative. Most of the students preferred Clinical round (40%) followed by Image-based round (22%); Diagnostic round (21%) and Rapid fire round (17%).

Conclusions: Quizzes are more effective than traditional self-study for improving academic performance, critical thinking, and retention in Pathology. Regular quiz integration can boost student interaction, engagement and learning outcomes in medical education.

Keywords: *Quiz, Teaching-learning Method, Pathology, Reinforcement.*

INTRODUCTION

Learning is a multifaceted process, involving complex mental skills like critical thinking and problem-solving. At first glance, quizzes may seem like mere tools for testing knowledge. However, when used strategically, they offer much more than that. Quizzes can foster active learning, promote critical thinking, and boost student engagement. One of the most significant advantages of quizzes is that they provide students with immediate feedback. This helps reinforce learning and allows students to address misconceptions right away. Quizzes can transform a potentially dry subject into an engaging activity. By adding elements of competition or collaboration, quizzes can turn learning into a more exciting and participatory experience. After taking a quiz, students can assess their strengths and weaknesses, helping them develop a

more accurate understanding of where they need to focus their efforts. By using quizzes regularly as low-stakes assessments, teachers can reduce the stress associated with final exams or high-stakes tests. Quizzes provide a less intimidating environment for students to test their knowledge and reduce the pressure they may feel during major assessments.

Pathology is a fundamental subject in medical education, bridging basic sciences and clinical practice. However, students often struggle with retaining complex concepts, correlating theoretical knowledge with clinical applications. As the new curriculum has taken a leap from teacher- centric approach to student-centric approach, the emphasis of active learning methods is necessary to help students achieve competency in key subject areas. In medical education, making subjects engaging and accessible requires exploring creative and innovative teaching methods. One effective approach among many is incorporating quizzes, which not only encourage active participation but also help reinforce key concepts, assess understanding, and also foster a more interactive learning environment (1). Quizzes serve as an innovative tool that can shift passive learning into an interactive experience. Over time, it became associated with formal assessments like exams and tests. Quizzes can bridge the gap between theoretical knowledge and practical application, promoting deeper cognitive engagement and enhancing learning (2). Therefore, quizzes have been widely used by educators in both medical and non-medical fields to enhance critical thinking, and boost performance on subsequent tests and assignments (3). Quizzing serves as an innovative teaching-learning (T-L) method to foster a deeper understanding of Pathology, enhance students' knowledge, and aid in the development of essential diagnostic and clinical assessment skills. It encourages interactive learning through techniques such as dividing the class into small groups, engaging the audience with questions, and incorporating clinical case scenarios (5).

AIMS AND OBJECTIVES:

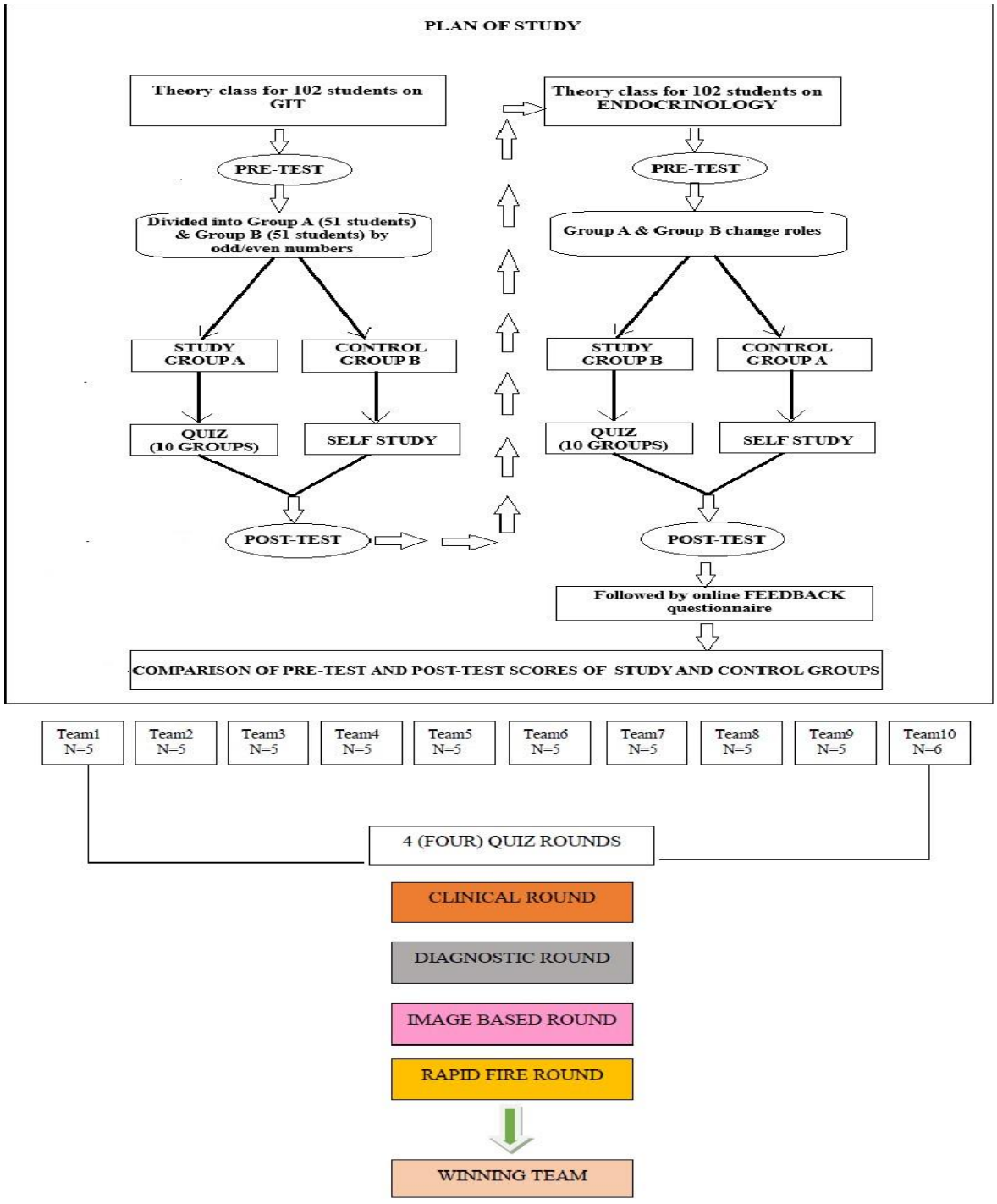
Aim: To reinforce learning in the subject of Pathology for Phase II MBBS students using Quiz as a Teaching -Learning modality.

Objectives:

- To implement quizzes as reinforcement learning tool in the subject of Pathology for Phase II MBBS students.
- To study the impact of quiz as a Teaching Learning modality for reinforcement of learning in the subject of Pathology for Phase II MBBS students.

MATERIALS & METHODS:

- **Study design:** Interventional study
- **Study duration**: 6 months
- **Study participants**: Phase II MBBS students of Batch 2023
- **Inclusion criteria:** All Phase II MBBS students of Batch 2023 present
- **Exclusion criteria:** Those students absent during the sessions
- **Study setting:** Diphu Medical College & Hospital, Diphu, Karbi Anglong
- **Sample size:** All 102 students of Phase II MBBS, Diphu Medical College & Hospital
- **Sampling Method:** After completing a system of Pathology, the sensitization of the students and faculty about the study was done and written consent from the students were obtained in consent forms. A 20 marks pre-test with MCQs having mostly clinical case scenarios from the topic was given to the students. Then, two groups were made; one which is Study group (51 students odd/even numbered) who participated in the quizzes in groups of 5 (total 10 groups) with four rounds: Clinical, Diagnostic, Image-based, and Rapid Fire and the other group is Control group (51 students who went for self-study) and there was a crossover between the Study and Control groups in the second quiz which was taken after the completion of another system in the same manner. The quizzes were interactive, with feedback provided after each round and duration was 1½ hours. The post-test was conducted after the quizzes and on completion of the two pretest and posttests, an online student perception & feedback was collected from the students with pre-validated questionnaire (closed ended mainly & one open ended response) which was recorded using three-point Likert scale. Faculty feedback was taken about this initiative. Pretest and post test scores were compiled and recorded.
- **Clinical Round:** 10 marks for each correct answer, -5 marks for incorrect answer
- **Diagnostic Round:** 10 marks for each correct answer, -5 marks for incorrect answer
- **Image based Round**: 10 marks for each correct answer, -5 marks for incorrect answer
- **Rapid Fire Round:** 20 marks for each correct answer, -10 marks for incorrect answer



QUIZ format for 51 students each of Group A & Group B

OBSERVATIONS AND RESULTS:

The scores from the students for the two pretests and post-tests tests were analyzed using paired t test , mean, and standard deviation (SD) to assess the effectiveness of the quiz-based learning method. The P- value < 0.05 was considered significant.

On the topic of GIT (phase 1 intervention) and Endocrine system (phase 2 intervention), students from the quiz group performed better compared to the study group and was found statistically significant.

Table 3 depicts that, students those who underwent quiz programme performed better (mean difference = 2.01) in post-test and found statistically significant. The results of self-study group were found insignificant, even though students performed well in the post-test (mean difference = 0.41).

Overall, students participating in quiz performed well in the post-test than compared to pretest which was statistically significant (shown in both Table 4 & Figure 2).

(Table1 & Table 2 Figure 1) shows the within each intervention phase group improvement comparison.

Figure 1: Theme wise (GIT & Endocrine system) pretest and post-test mean score

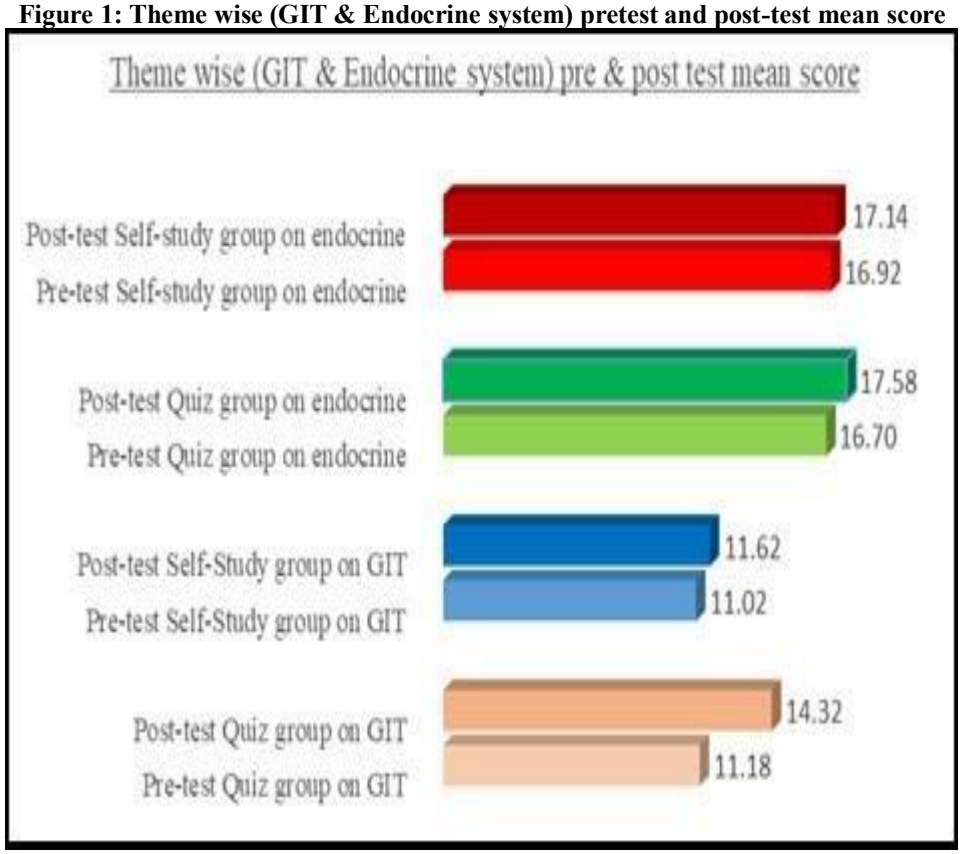


Table 1: Pre-test and Post-test comparison: Gastrointestinal Tract

Group	Category	SD	t	p-Value
Quiz Group	Pre-test	3.445	-5.375	0.000
	Post-test	3.909		
Self-study Group	Pre-test	3.127	-1.738	0.088
	Post-test	2.996		

Table 2: Pre-test and Post-test comparison: Endocrine System

Group	Category	SD	t	p-Value
Quiz Group	Pre-test	1.632	-2.915	0.005
	Post-test	1.341		
Self-study Group	Pre-test	1.736	-.650	0.519
	Post-test	1.885		

Table 3: Overall Pretest and Post-test comparison of both quiz and self-study group

Group	Category	M	SD	95% of CI of Difference		T	p-Value
				Lower	Upper		
Quiz Group	Pre-test	13.94	3.858	-2.697	-1.323	-5.805	0.000
	Post-test	15.95	3.337				
Self-study Group	Pre-test	13.97	3.888	-.889	.069	-1.699	0.092
	Post-test	14.38	3.728				

Table 4: Overall comparison of Pretest and Post-test group

Category	M	SD	95% of CI of Difference		T	p-Value
			Lower	Upper		
Pre-test	13.96	3.864	-1.640	-.780	-5.551	0.000
Post-test	15.17	3.616				

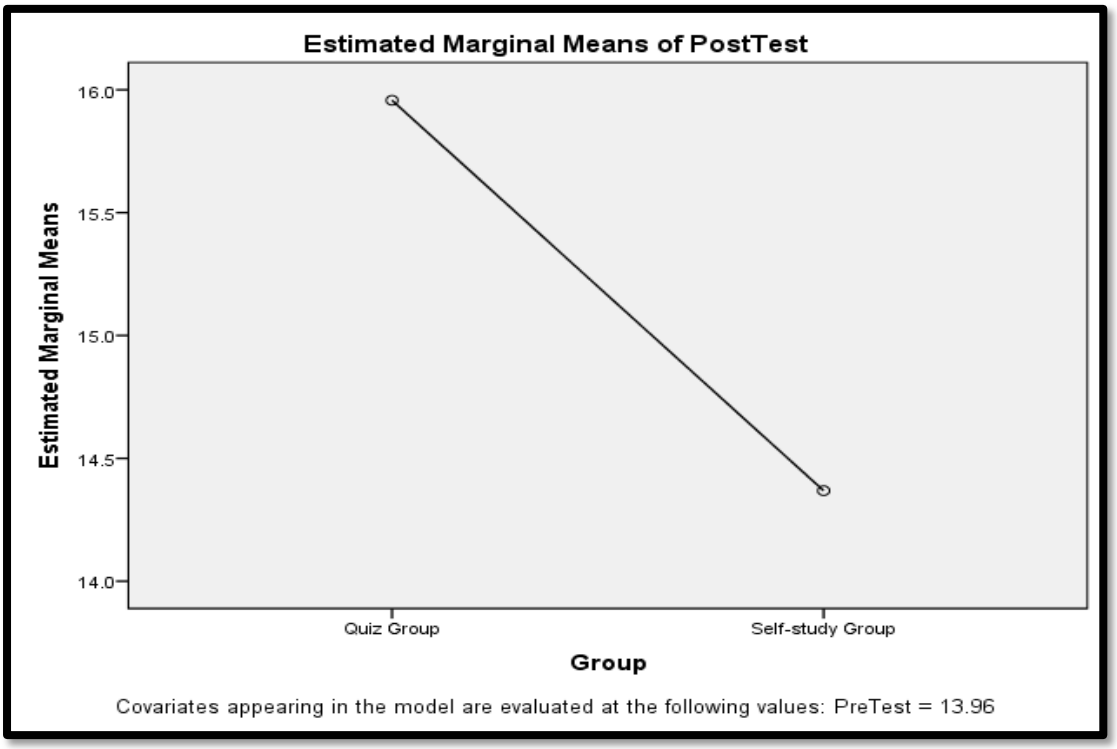


Figure 2: Pretest and Post-test analysis by controlling Pretest (Custom model)

Close-ended items of the feedback questionnaire to evaluate students' perceptions were analyzed by quantitative analysis using a three-point Likert scale as the percentage. (Shown in Table 5)

Table 5: Feedback perception from the students on organizing the quizzes

Item	Agree (%)	Neutral (%)	Disagree (%)
The contents of the quiz helped to bridge the knowledge gap.	95 (95.0%)	05 (5.0%)	-
Quiz helps in recall & reasoning	98 (98.0%)	02 (2.0%)	-
The contents of the quiz were satisfactory	97 (97.0%)	03 (3.0%)	-
Guessing the answer plays some role	84 (84.0%)	15 (15.0%)	01 (1.0%)
Quiz enhances interest in Pathology	90 (90.0%)	10 (10.0%)	-
Such quizzes will improve student's performance in examinations	89 (89.0%)	09 (9.0%)	02 (2.0%)
Quiz is better than self-directed learning	74 (74.0%)	22 (22.0%)	04 (4.0%)

Attending quiz was a waste of time	04 (4.0%)	09 (9.0%)	87 (87.0%)
We should conduct more such quizzes in future for revision of topics	86 (86.0%)	13 (13.0%)	01 (1.0%)

Most of the students (n=40; 40%) expressed their interest in Clinical round followed by Image-based round (n=22; 22.0%); Diagnostic round (n=21; 21.0%) and Rapid fire round (n=17; 17.0%). Majority of the students (n=65; 65.0%) preferred Case-based questions followed by Image-based questions (n=28; 28.0%). Only 7% of the student could not express their views on question patterns.

DISCUSSION:

Since the quiz session was interactive, they engaged in active recall and reasoning skills thus becoming a more effective way to retain information than passive reading. Better enhancement of memory and reinforcement of the student's knowledge was seen. Research has shown that regular quizzes help improve long-term retention of information. When students actively recall information during a quiz, it strengthens neural connections in the brain, making it easier to remember the material in the future. This technique, called "retrieval practice," is highly effective in boosting memory retention. Quizzes can encourage students to reflect on their own knowledge and understanding. Self-study however, allows individuals to learn at their own pace and tailor their learning approach to their needs. It may involve re- reading or summarizing which is less effective than being tested repeatedly. There is no formative correction unlike quizzes which provide immediate feedback allowing the learners to identify areas where they need more practice. This level of consistency is challenging to achieve through traditional lectures or self-study, where student attention spans often vary. Quiz-based interventions are usually scaffolded with focused questions aligned with key learning objectives but self-study might be unstructured or vary depending on how diligently students approach the subject material.

In our study, the pretest scores from the two interventions were significantly lower than the post test scores, indicating improved understanding of the topic and we could assess the effectiveness of the quiz-based learning method. The standard deviation was higher in the pretest and markedly reduced in the post test, suggesting a more uniform distribution of knowledge among students. In both the interventions, students from the quiz group performed better compared to the self-study group (Table-3). Even though, the self-study group performed well in posttest, the results were statistically insignificant whereas the quiz group performed markedly well and the results were found statistically significant. However, the larger difference in pretest and post test scores during the first intervention compared to the second may partially reflect a Hawthorne effect, where students demonstrated increased performance due to novelty of the assessment method and the awareness of being observed. As the intervention became routine by the second round, the motivational boost may have diminished (Figure-1). The findings of the present study, demonstrating a statistically significant improvement in post-quiz scores are consistent with those reported by Saba Khan et al who also observed a significant enhancement in student's performance following quiz-based learning interventions. The quizzing session in their study helped clarify the learning objectives and outcomes expected from students upon completing a teaching module on cephalometrics. Pretest scores of 40+25/100 were improved to post-test scores of 82+7/100 using paired t test and it showed a significant correlation between pretest and posttest indicating a significant improvement. Clinical images and case-based materials proved to be effective tools for subjects like this, as they support clinical reasoning and serve as powerful aids for memory retention (4). Goud et al study compared between the students who participated in the quiz competition with non-quiz participants. They found that student's performance was much better and statistically significant in quiz participants than the non-quiz participants (5). We can also think of quizzes serving as an effective method of assessment because assessment plays a crucial role for both educators and learners. It not only provides valuable feedback on teaching strategies but also highlights students' strengths and areas needing improvement. This insight enables teachers to refine their instructional approaches, ultimately enhancing the quality of future teaching sessions (4). Our findings also align with those of K. Devi, who implemented a quiz as an innovative teaching strategy in community medicine for medical students. The study concluded that the quiz method was effectively used to teach International Health to undergraduate medical students (7).

To the best of our knowledge, there is limited literature available on the effectiveness of quizzes as a learning tool in the subject of Pathology, which holds significant relevance in laboratory medicine and patient care. This study aims to highlight the importance of Pathology by utilizing quizzes as an educational strategy, with the goal of fostering greater student engagement and encouraging deeper understanding of the subject matter (2). To assess students' perceptions of quizzes as an active learning method, we collected their feedback, which was overwhelmingly positive. In feedback session, majority of the students showed their best interest to conduct quiz competition (Table-5). Students preferred quizzes over traditional teaching methods, describing them as innovative, engaging, and informative. Clinical case-based questions further enhanced their ability to apply theoretical knowledge to practical scenarios, sparking greater interest in the subject. Similar findings have been reported in other studies, supporting the effectiveness of quiz-based learning as an engaging and impactful teaching tool (2, 5, 6,7).

A common concern is that quizzes, especially the ones based on multiple-choice questions, only assess knowledge acquisition and memory rather than higher-order cognitive skills referring to Bloom's Taxonomy. But our quiz had 4 rounds to assess a range from lower-order to higher- order cognitive skills. Medical educators are encouraged to actively foster student interest in the subject, promoting independent learning and a lifelong attitude toward knowledge acquisition, essential for both medical practice and patient care. Among various modern teaching methods—such as small group sessions, self-directed learning, tutorials, flipped classrooms, and quizzes—quizzes stand out as they combine student-centered and problem-based learning, effectively engaging all three learning domains and stimulating active participation. (2)

CONCLUSION:

The use of quizzes as an active learning strategy appears to be more effective than traditional self-study methods in enhancing the academic performance and retention of knowledge in Pathology among Phase 2 MBBS students. This suggests that integrating regular quizzes into the teaching methodology may improve student engagement and learning outcomes in medical education thus reducing exam anxiety. Scores in the examination can be expected to improve as far as Pathology is concerned. Quizzes are a powerful tool for reinforcing pathology concepts, improving clinical reasoning, and making learning interactive. Revision process will become effective and enriched. Inclusion of case based & clinical scenarios is expected to enhance conceptual clarity by linking theory to clinical practice. However, their future depends on optimal integration with modern teaching methodologies and technical advancements. The quizzes will have to be well structured for serving our purpose. Students along with faculties have to be impressed upon the utility of such a modality. Faculty training on quiz-based pedagogy must be gradually implemented. Limited time in the curriculum for quizzes has to be sorted out.

LIMITATIONS:

Short duration of intervention may fail to capture long-term retention or learning effectiveness. Variability in individual student motivation and uncontrolled learning styles may have influenced performance. The post-test may not fully assess higher-order cognitive skills (application, analysis, etc.) and might favor recall, which benefits quiz-trained students.

Conflict of Interest: None

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