

## Original Article

**Quiz as an adjunctive modality in teaching Clinical Microbiology for Undergraduate Medical Students**Abhishek Mehta<sup>1\*</sup>, Kiran Tripathi<sup>2</sup>, Himanshi Bansal<sup>3</sup><sup>1</sup>Associate Professor, Department of Microbiology, Govt. Medical College, Datia (MP), India<sup>2</sup>Professor & Head, Department of Microbiology, Govt. Medical College, Datia (MP), India<sup>3</sup>Demonstrator, Department of Microbiology, Govt. Medical College, Datia (MP), India.**\*Corresponding Author:** Dr. Abhishek Mehta, E-mail: abhishekmehta623@gmail.com**ARTICLE INFO***Article history*

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**Key words:**Lecture,  
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Self Directed Learning,  
Teaching Modality**ABSTRACT**

Conventional teaching modalities like Didactic lectures if practised alone fails to transfer concepts as effectively as active learning approaches. Active learning methods like Quizzing leads to active participatory involvement of students, motivates them by increasing interest in the subject and act as a driving force for more effective learning. The purpose of this study was to evaluate the effectiveness of Quiz as an adjunctive teaching modality in clinical microbiology for undergraduate medical teaching and to compare it with conventional teaching methods like Didactic lectures. In this interventional study conducted in the Dept. of Microbiology of a Govt. Medical College of Central India, Second MBBS students were divided into two groups. The topic Universal precautions was split and covered through two modules. One module was administered through lecture to one group and through Self study followed by Quiz to another group. Cross over was done for the second module. To evaluate the students performance pretest and post test were conducted for both the methods. In case of both the groups a significant absolute learning gain was observed for both the modalities. However in both the groups the learning gain and effect size were towards much higher side for Quizzing as compared to didactic lectures. Our study has shown the positive impetus of the active teaching learning modalities like Quizzing on self directed learning, and an added advantage of this approach on the learning gain as compared to the conventional teaching.

**INTRODUCTION**

Didactic lectures one of the conventional teaching tool is still the pre-dominant form of teaching in medical education system in India. Such conventional modalities if practised alone fails to transfer concepts effectively as active learning approaches. These are even less effective at developing skills and in generating attitudes and serve only as a data transferring tools. Moreover the attention span of a student during conventional lectures is just 15-20 minutes and thereafter declines abruptly in absence of triggers (1-3).

So, there is increasing need to introduce newer active teaching learning modalities as reinforcers in learning process. The medical education system should be designed to foster active self directed learning. Active learning methods like Quizzing leads to active participatory involvement of students, motivates them by increasing interest in the subject and act as driving force for more effective learning with better understanding of concepts (1,4,5).

This is the need of the hour to explore and investigate the utility of active teaching learning modalities like Quizzing in Medical education.

In the light of above facts, an interventional study was planned to ascertain the effectiveness of Quiz as an adjunctive teaching modality for undergraduate medical students at the Dept. of Microbiology, Govt. Medical College, Datia, India.

**METHODS**

This Non-randomised cross over study was conducted in the Dept. of Microbiology, Govt. Medical College, Datia, India after obtaining permission from institutional ethics committee.

The Second MBBS Students were divided into two study groups, Group-A and Group-B each comprising 50 students. The topic "Universal Precautions for medical professionals" was split into two sections to be covered in two sessions/modules, one for each group separately.

Module-1: Hand hygiene, Personal Protective Equipment, Decontamination, Asepsis, Respiratory hygiene/Cough etiquettes.

Module-2: Spills management, Splash management, Sharps management, Biomedical waste management.

Prior to commencing the study, the students were sensitized regarding the content of study, study plan, purpose/rationale behind conducting the study and its implications or scope. Participation in study was voluntary after taking informed consent from study subjects.

In the first session Group-A was taught the topic by Didactic lecture and Group-B by self study followed by Quiz. For the second session/module cross over was done (Figure 1).

Two separate lecture sessions were conducted covering two modules, one for each group, in well equipped Lecture theatre through power point presentations, attended by 40 students from each group.

The plan and content of Quiz was finalized after discussion with senior Faculty and subject experts. The questions were framed by senior Faculty and Quiz was conducted by the principal investigator with the help from other Faculty and non-teaching staff. The topic and schedule of the quiz was announced one week in advance. The students were instructed to refer to the standard textbooks and authentic study material. The students were sensitized regarding the learning resources well in advance.

Two quiz sessions, each attended by 34 students were conducted in the Dept. of Microbiology.

Quiz-1: Module-1 Quiz-2: Module-2

Each Quiz session comprising of Four rounds: (duration: 2 hrs.)

Round-1: True/False round

Round-2: MCQs round

Round-3: Visual round

Round-4: Rapid Fire round

Each group was divided into four sub-groups and 2 students from each were randomly selected as quizzers on the day of Quiz so that everyone will read and come. Four teams were formed with two students in each team, while rest of the students were the audiences.

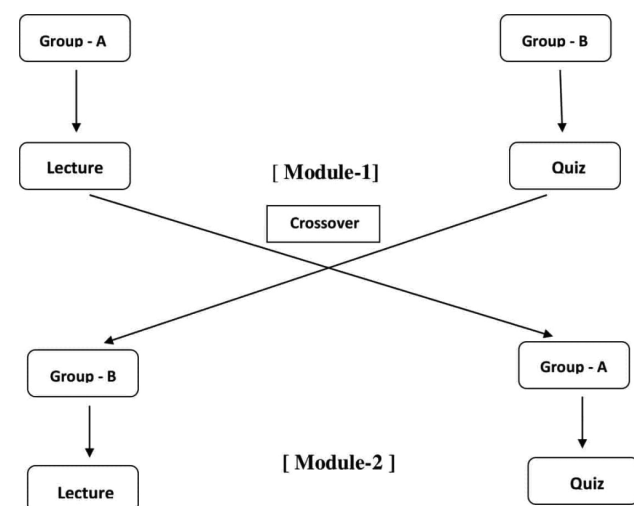


Figure 1. Crossover of teaching modules

There was no negative marking for wrong answers. The decision of the Quiz master was final in deciding the correct answer and awarding marks. Cumulative scores of all the rounds were taken to decide the winning team.

To evaluate the students learning, pretest and post test were conducted for all the students for both the methods. A self administered pre structured questionnaire comprising of 10 MCQs or True/False questions was administered to each participant as pretest and same questions repeated in post test. Time allocated for pre-test/post-test was 15minutes each. Whenever the subjects felt difficulty in understanding the questions their doubts were cleared and questions were explained (1,2,6,7).

### Statistical Analysis

The post test was conducted immediately after completion of topic for both the groups. The mean pretest and post test scores for the lecture and Quiz method were compared individually by using student's paired t-test.

The performance of both the groups when subjected to the two teaching modalities was compared by using unpaired t-test.

"p" value of less than 0.05 considered as statistically significant.

To study the effectiveness of the intervention, Class average normalized gain (g) was calculated by Hake's criteria and Effect size metrics by Cohen's -d. [7,8,9]

1) Class average normalized gain (g) by Hake's criteria.

$$g = \frac{\text{Post test} - \text{Pre test}}{\text{Max. score} - \text{Pre-test}}$$

Where brackets indicate Class averages.

[Class average normalized gain is categorized as 0.1 to 0.29 as low gain, 0.3 to 0.69 as medium gain and 0.7 to 1.0 as high gain.]

2) Effect size metrics by Cohen's -d

$$\text{Cohen's } d = \frac{M_2 - M_1}{SD_{\text{pooled}}}$$

$$SD_{\text{pooled}} = \sqrt{((SD_1^2 + SD_2^2)/2)}$$

$M_1$  = Mean score of Pre-test

$M_2$  = Mean score of Post-test

$SD_1$  = Standard deviation in pre-test

$SD_2$  = Standard deviation in post-test

$SD_{\text{pooled}}$  = pooled standard deviation.

### RESULTS

Out of 100 students 80 students attended didactic lectures while 68 students attended Quiz.

As shown in Table-1 and 2, in case of both the modules it was found that the difference in mean scores of Pre-test and Post-test for both teaching-learning modalities was highly significant statistically. There was a significant absolute learning gain observed for both the modalities. However in both the groups the learning gain and effect size were towards much higher side for Self Directed Learning (SDL) + Quizzing.

As depicted in Table-3, for Module-1 covered through Lecture for Group-A and through Quiz for Group-B, a

**Table 1.** Inferential statistics for module-1

Group	Method	Test	Mean Test Score ± SD	SEM	N	t-value	p-value
A	Lecture	Pre-test	13.35 ± 4.2	0.66	40	13.5266	<0.0001**
		Post-test	15.45 ± 3.69	0.58	40		
B	SDL +Quiz	Pre-test	9.03 ± 3.65	0.63	34	26.75	<0.0001**
		Post-test	17.5 ± 2.7	0.46	34		

**Table 2.** Inferential statistics for module-2

Group	Method	Test	Mean Test Score ± SD	SEM	N	t-value	p-value
A	Lecture	Pre-test	9.3 ± 3.55	0.56	40	24.95	<0.0001**
		Post-test	14.35 ± 3.81	0.60	40		
B	SDL +Quiz	Pre-test	11.06 ± 4.65	0.80	34	13.36	<0.0001**
		Post-test	17.94 ± 2.85	0.49	34		

SDL-Self directed learning, SD-Standard deviation, SEM-Standard Error of Mean, N-Sample size

Significance calculated using paired t-test \*p<0.05(Significant), \*\*p<0.001(Highly significant), p>0.05(NS:Not significant)

**Table 3.** Comparison of students’ performance in both methods of teaching

Test	Module-1			
	Mean Test Score ± SD		t-vlaue	p-value
	Lecture	Quiz		
	Grp.A	Grp.B		
Pre-test	13.35 ± 4.2	9.03 ± 3.65	4.6836	0.0001**
Post-test	15.45 ± 3.69	17.5 ± 2.7	2.6867	0.009*
	Module-2			
	Grp.B	Grp.A		
Pre-test	9.3 ± 3.55	11.06 ± 4.65	1.8421	0.07(NS)
Post-test	14.35 ± 3.8	17.94 ± 2.85	4.5208	0.0001**
N	40	34		

Significance calculated using unpaired t-test \*p<0.05(Significant), \*\*p<0.001(Highly significant), p>0.05(NS:Not significant)

significant difference was observed between mean Pre-test scores as well as mean Post test scores. But for Module-2, covered through Lecture for Group-B and through Quiz for Group-A, there was no significant difference observed between mean Pre-test scores, however difference in mean Post-test scores was highly significant. This means that for Module-2, prior to intervention, the knowledge and awareness level regarding the topic was almost same in both the Groups. However post intervention, this level turned out towards higher side for Group-A which was subjected to SDL + Quizzing; as compared to Group-B subjected to didactic lecture.

As depicted in Table-4 & Fig.2, for both the groups, there was significantly high absolute learning gain through lectures as well as Quiz. As far as learning gain or effect size metrics are concerned both the groups followed similar pattern with the Quiz modality scoring higher over the lectures. In both the groups the learning gain and effect size were towards much higher side for SDL + Quizzing as compared to didactic lectures as evident from Hake’s Class average

**Table 4.** Comparison of learning gain/ effect size metrics between two methods

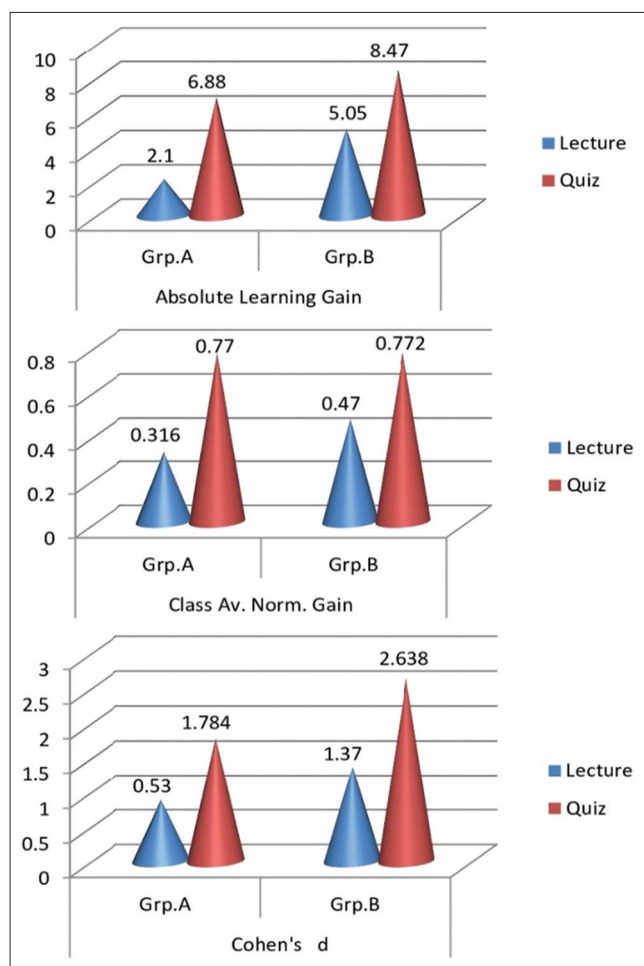
Method	Group-A				
	Mean Test Score		Absolute learning Gain	Class average Normalised gain (g)	Cohen’s-d
	Pre-test	Post-test			
	Lecture	13.35	15.45	2.1	0.316
Quiz	11.06	17.94	6.88	0.77	1.784
	Group-B				
Lecture	9.3	14.35	5.05	0.47	1.37
Quiz	9.03	17.50	8.47	0.772	2.638

Normalised gain (g) and Effect size metrics by Cohen’s -d. The former calculated for both the groups clearly indicates High learning gain (>0.70) for the SDL + Quizzing method and Medium gain for didactic lectures.

**DISCUSSION**

In both the groups the learning gain and effect size were towards much higher side for SDL + Quiz. This clearly indicates that such pro-active learning tools involving active participation of students in the learning process are much more efficient than the traditional modalities like didactic lectures. Though these conventional tools are still relevant today and had shown a significant learning gain for the topics covered in this study. So, they are definitely having an important place in the medical education system and can never be replaced completely by any newer modalities. But the introduction of new active teaching learning methods like quizzing does have a much positive impact on our education system and can nicely complement the conventional methods acting as an adjuvant.

So, there is increasing need to introduce newer active teaching learning modalities as reinforcers in learning process. The medical education system should be designed to



**Figure 2.** Comparison of learning gains between didactic lecture and quiz

foster active self directed learning. Active learning methods like Quizzing leads to active participatory involvement of students, motivates them by increasing interest in the subject and act as driving force for more effective learning with better understanding of concepts. While searching the learning resources, going through the study material, preparing for the quiz, they are encouraged and motivated towards self directed learning.

Our findings are in accordance with a number of similar studies conducted in recent past (1,6,7,10,11,12).

In a study by Sawarkar G et al 2018, while comparing Quiz with didactic lectures; pre-test was conducted once and post-test twice for both the groups. First post test immediately after the session and second 15 days after the session to evaluate the retention of knowledge.

Like our study though there was statistically significant difference between the mean Pre-test and post test scores for both the groups but higher difference was seen for the group subjected to Quizzing as compared to the Lecture. The difference in mean post test scores between the two post tests for both modalities indicate a better retention of knowledge for Quizzing. The class average normalized learning gain depicted high gain for Quiz and medium gain for lecture. This indicates that the intervention in the form of quiz was more effective than the Lecture (7).

In the study by Devi K 2017, the topic International Health was taken for two different batches of 3<sup>rd</sup> MBBS by lecture method and by Quiz method each session lasting one hour. Using paired t-test, the differences between the pre and post-test scores for each group was statistically significant. The post test mean score after Quiz was higher compared to that after lecture the difference being statistically significant. This finding is in accordance to our study (1).

In the study by Shajia Asim et al 2015, Mean pre-test and post test scores of the students revealed a statistically significant absolute learning gain. This finding is similar to our study however in this study the Quizzing was not compared to the conventional teaching modalities like Didactic lectures as was done in our study (12).

In the study by Talsania N et al 2015, unlike our study, cross over was not done between the two groups. Feedback from students as well as faculties was elicited after the Quiz on five point Likert scale. Like our study in this study too, the difference between mean test scores of pre-test and post-test for both groups was statistically significant. There was a highly significant learning gain seen for both the modalities. In the perception survey, most of the students found Quiz as interesting, enjoyable, motivating and more interactive (6).

Our study has shown the positive impetus of the active teaching learning modalities like Quizzing on self directed learning, and an added advantage of this approach on the learning gain as compared to the conventional teaching through didactic lectures. A few studies in the past have been conducted comparing traditional methods with the active learning approaches but none has covered this aspect.

## CONCLUSION

This study implies that though the conventional teaching modalities like Didactic lectures are still relevant today and can never be substituted or replaced completely by any newer approaches; but there is definitely an additive advantage of complementing them with newer active teaching learning modalities like Quizzing.

The intervention in the form of quiz is more effective in terms of learning, understanding, grasping and conceptualization than the conventional methods alone.

Quizzing through active participatory involvement of students, motivates them towards self directed learning, increases interest in the subject and act as a driving force for more effective learning with better understanding of concepts. This gives an additional thrust and has a positive impetus on the entire learning process. This adjuvant effect can be utilized for the betterment and strengthening of our Medical education system to be more effective in generating attitudes, professionalism and better skill development in a medical graduate.

## Declaration of Consent

Participation in study was voluntary after taking informed consent from study subjects.

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Nil.

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