

# Comparison of Academic Performance of 2<sup>nd</sup> MBBS Students Participating in Quiz Versus Nonparticipants: A Retrospective Analysis

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## Abstract

**Introduction:** Pharmacology quiz participants undergo training by their teachers on pharmacology which is much more rigorous than routine pharmacology teaching program. Effect of this training for pharmacology quiz on the performance of students in the 2<sup>nd</sup> year MBBS exams, i.e., terminal, preliminary, and university exam has not been evaluated.

**Methodology:** Study was a retrospective analysis of scores of three exams (1<sup>st</sup> term, 2<sup>nd</sup> term, and prelim) conducted in 2<sup>nd</sup>-year MBBS student in the department of pharmacology of four batches. Participants were students who had given their names for participation in the quiz and had undergone pre-quiz training and selected candidates were among the participants who got selected to take part in the final quiz. Participants were trained for the quiz. Rest of the students were considered as nonparticipants. Equal number of topper nonparticipants was chosen based on number of selected students. Marks between the groups were compared with paired and unpaired *t*-test, Mann-Whitney *U*-test, and Wilcoxon Signed-rank test.  $P < 0.05$  was considered statistically significant.

**Results:** Out of a total of 728 students, 147 were participants, 131 participated but not selected, and 16 got selected, 581 were nonparticipants, 16 toppers were selected. The theory, practical and combined marks of participants and selected students were higher than nonparticipants and not selected students, respectively. Practical and combine marks of topper nonparticipants were higher than the selected students at baseline, but in 3<sup>rd</sup> term the difference was not significant ( $P > 0.05$ ).

**Conclusion:** Quiz-based teaching in pharmacology enhances performance in pharmacology.

**Key words:** Contest, Exam, Learning, Teaching methods

## INTRODUCTION

A quiz program is a test of knowledge between individuals and teams, as a form of entertainment. The quiz format provides motivation not only for participants but also for the audience, because it provides four kinds of gratification and appeals: (1) Self-rating appeal: On a primary level, it serves as a tool of self-assessment of intellectual status

or subject knowledge in relation to the others; (2) social interaction: Questions can encourage social interaction because they can be discussed within the team and at audience level; (3) excitement appeal: The appeal of winning a prize or being rated as superior among peers; and (4) educational appeal: Quizzes serve as educational tools by encouraging thinking and learning.<sup>[1]</sup>

Applying collaborative and cooperative learning theories, group quizzes serve as effective means of education. Quizzes engage participants in collaborative learning by helping them harness joint intellectual effort and group processing. They also promote positive interdependence and motivate participants for cooperative learning. In addition, they improve recall of information, generate discussion, and prompt those with no knowledge (even among audience) to learn.<sup>[1]</sup>

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The role of teaching quality cannot be ignored in recent brilliant scientific advances. One of the major challenges of teaching is finding an approach to increase students' level of understanding and learning. Various teaching techniques have resulted in different outcomes.<sup>[2]</sup>

It is documented that students preserve about 20% of items taught during a 45-min lecture, but the active participation of students in the learning process would increase the level of students' understanding. Quizzes and assignments, as teaching aid equipment, can provide appropriate feedback and error correction for students during educational courses.<sup>[2,3]</sup>

Active participation in the educational processes, they would acquire the desired education, and by attaining knowledge, attitudes, and necessary expertise, they achieve certain professional skills to serve the community.<sup>[2]</sup>

Pharmacology is a paraclinical subject taught in 2<sup>nd</sup>-year MBBS in India. There are few students who participate in quiz program. The students usually participate in many local, regional, state, national, and international level pharmacology quizzes. These are the type of students who are inherently motivated and want to learn and achieve more. However, many a times, we feel they are better academic achievers than their counterparts as they are willing to venture and explore different type of intellectual learning and evaluation. A puzzle-based pedagogy, when compared to traditional lecture-based teaching, has effectively enhanced the performance of students on standard course-specific assessments when evaluated by quiz and test scores in physiology and anatomy.<sup>[3]</sup>

Pharmacology quiz participants undergo training by their teachers on pharmacology which is much more rigorous than routine pharmacology teachings program.

Department of Pharmacology and Therapeutics, Seth GSMC, Mumbai, had been conducting pharmacology quiz since 2001. This activity was started as intent to create interest in the subject of pharmacology. There are different methods to teach pharmacology, but generally pharmacology as a subject is felt tough by students, and very few students excel in this subject. There are various factors which can lead to their better performances, so we thought quiz could be one of the factors. Effect of training in pharmacology quiz on the performance of students in the 2<sup>nd</sup>-year MBBS exams (1<sup>st</sup> terminal, 2<sup>nd</sup> terminal, and prelims exam) has not been evaluated. We planned this study to find and compare the pharmacology exam scores of students who participated in the quiz and got selected for the final quiz versus those who did not.

## METHODOLOGY

This study was a retrospective analysis of marks (scores) of 2<sup>nd</sup> MBBS students of August 2012–2016 batches. The data is under the Department of Pharmacology and Therapeutics, and the respective permission of Departmental Head and Institutional Ethics Committee (IEC) was sought to access the data. Confidentiality and privacy of data was maintained.

### Definition of the Terms used in the Study

(1) Participators: Students who have given their names for participation in the quiz and cleared all the elimination round and received training for final quiz competition, (2) nonparticipators: Students who have never participated in pharmacology quiz and have not received any pre-quiz training, (3) selected: Students who got selected in the final quiz and took part in the quiz, (4) participated but not selected: Students who participated and got pre-quiz training but did not get selected for the final quiz, and (5) topper nonparticipators: Students who had not participated in the quiz but were class topper when an average of 1<sup>st</sup> and 2<sup>nd</sup> term marks was considered.

The list of students participating in the quiz and the four selected students list was available in the department of pharmacology. Their respective scores of 1<sup>st</sup> terminal, 2<sup>nd</sup> terminal, and 3<sup>rd</sup> term (preliminary) exams were also available with the department of pharmacology. The batch for consideration was August 2012–2016. Between years 2013 and 2017, five batches of students had participated in the pharmacology quiz. Data of one of the batches were not included in the analysis due to missing/incomplete data of quiz participating students. The data were retrospectively analyzed in the next 2 months. This was a single-center retrospective study conducted in the Department of Pharmacology of Seth GS Medical College and KEM Hospital. Exemption from Ethics Committee Review was sought from IEC.

The student's name was anonymized and coded so that the evaluator was blinded during analysis. Confidentiality and privacy of the students was maintained.

Archived data of marks of students in 1<sup>st</sup> terminal examination, 2<sup>nd</sup> terminal examination, and preliminary examinations were noted down in the Microsoft Excel sheet. Marks of written theory exam, practical exam and theory viva were noted down. Multiple choices questions, short answer questions, and long answer questions were the domain in which affective, cognitive, and psychomotor skills were tested in theory exams. Spots, prescription writing, criticism of fixed-dose combination, rationality/irrationality of prescription, grand and pharmacy viva,

**Table 1: Association between percentage marks for an average of 1<sup>st</sup> and 2<sup>nd</sup> term marks (baseline) to 3<sup>rd</sup> term for participators, nonparticipators, selected, not selected, participated but not selected students and topper nonparticipators**

Groups	Mean	SD	Median	IQR	P value
1 <sup>st</sup> and 2 <sup>nd</sup> term average percentage marks (baseline) in theory					
Participators	57.43	9.75	57	51–65	<0.0001*
Non-participators	45.66	12.94	46.25	37.5–54.5	
Selected	64.56	8.81	65.75	60.13–69.13	<0.0001*
Not selected	47.65	13.08	48.25	39.5–56.5	
Selected	64.56	8.81	65.75	60.13–69.13	<0.0001*
Participated but not selected	56.57	9.54	56	50.50–63.50	
Selected	70.03	2.71	70	60.13–69.13	0.015*
Topper nonparticipators	64.56	8.81	65.75	67.63–72	
3 <sup>rd</sup> term percentage marks in theory					
Participators	64.26	8.68	64.38	57.5–70.63	<0.0001*
Nonparticipators	54.79	11.08	55.63	48.13–63.13	
Selected	71.88	8.09	73.75	67.81–77.19	<0.0001*
Not selected	56.36	11.12	57.5	49.38–64.38	
Selected	71.88	8.09	73.75	67.81–77.19	<0.0001*
Participated but not selected	63.33	8.31	63.75	57.5–70	
Selected	71.88	8.09	73.75	67.03–77.66	0.061
Topper nonparticipators	66.91	9.87	68.44	62.81–72.66	
1 <sup>st</sup> and 2 <sup>nd</sup> term average percentage marks (baseline) in practical					
Participators	66.80	8.17	67.50	61.75–72	<0.0001*
Nonparticipators	57.78	12.06	59.25	51.06–65.5	
Selected	72.10	5.92	71.09	68.56–78.03	<0.0001*
Not selected	59.30	11.90	60.81	52.66–67.25	
Selected	72.10	5.92	71.09	68.56–78.03	<0.0001*
Participated but not selected	66.15	8.19	66.63	61.13–71.50	
Selected	72.10	5.92	71.09	68.56–78.03	0.047*
Topper nonparticipators	76.48	4.18	76	73.72–77.97	
3 <sup>rd</sup> term percentage marks in practical					
Participators	65.78	9.16	66.5	60–72.6	<0.0001*
Nonparticipators	55.70	10.69	56.25	49–62.5	
Selected	72.20	7.97	73.85	66.25–76.25	<0.0001*
Not selected	57.42	11	57.5	50–65.72	
Selected	72.20	7.97	73.85	66.25–76.25	<0.0001*
Participated but not selected	65	9.01	66.25	59.9–72.5	
Selected	72.20	7.97	73.85	64.38–76.25	0.305
Topper nonparticipators	70	6.62	71.88	65.94–73.75	
1 <sup>st</sup> and 2 <sup>nd</sup> term average percentage marks (baseline) in theory+practical					
Participators	61.60	7.98	61.89	56.67–67.11	<0.0001*
Nonparticipators	51.05	11.72	52.28	44.14–59.11	
Selected	67.91	6.96	68.06	63.14–73.36	<0.0001*
Not selected	52.83	11.72	54.11	46.17–60.83	
Selected	67.91	6.96	68.06	63.14–73.36	<0.0001*
Participated but not selected	60.83	7.78	61.11	56.11–66.72	
Selected	67.91	6.96	68.06	63.14–73.36	0.029*
Topper nonparticipators	72.90	2.52	72.64	70.47–74.24	
3 <sup>rd</sup> term percentage marks in theory+practical					
Participators	64.77	8.15	65.42	58.75–70.54	<0.0001*
Nonparticipators	55.09	10.10	55.83	48.67–62.5	
Selected	71.98	7.31	73.5	68.12–76.45	<0.0001*
Not selected	56.71	10.30	57.5	50.42–63.78	
Selected	71.98	7.31	73.5	68.12–76.45	<0.0001*
Participated but not selected	63.88	7.82	64.58	58.33–69.58	
Selected	71.98	7.31	73.50	67.6–76.77	0.102
Topper nonparticipators	67.94	8.19	68.37	65.57–72.71	

\*Significance with  $P < 0.05$  using Mann–Whitney  $U$ -test. IQR: Interquartile range

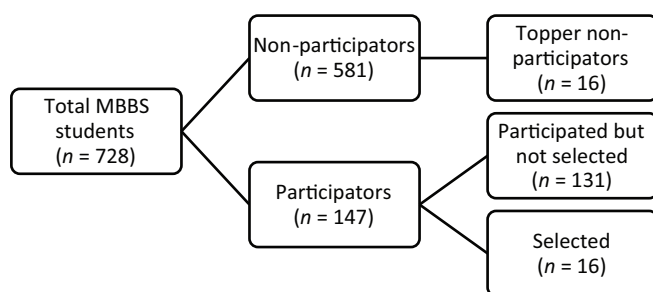
and objective structured clinical examination/objective structured practical examination along with oral and vocabulary skills are tested in practical exam. A total score of students in theory and practical exam was

considered for statistical analysis. Baseline score (average of 1<sup>st</sup> and 2<sup>nd</sup> terminal examination marks) was assessed between participators and nonparticipators, selected and non-selected students, selected, and participated but not

**Table 2: Within the group paired data comparison of the average of 1<sup>st</sup> and 2<sup>nd</sup> term marks (baseline) with 3<sup>rd</sup> term marks**

Exam	Groups	1 <sup>st</sup> and 2 <sup>nd</sup> term average percentage marks (baseline)		3 <sup>rd</sup> term percentage marks		P value
		Mean	SD	Mean	SD	
Theory	Participants	57.44	9.76	64.26	8.68	<0.001*
	Nonparticipants	45.67	12.95	54.05	12.71	0.001#
	Selected	64.57	8.82	71.88	8.10	0.012*
	Not selected	47.66	13.09	55.74	12.55	<0.001#
	Participated but not selected	56.57	9.54	63.33	8.31	<0.001*
	Topper nonparticipants	70.04	2.72	66.92	9.87	0.185
Practical	Participants	66.80	8.18	65.79	9.16	0.112
	Nonparticipants	57.79	12.07	54.95	12.43	0.001#
	Selected	72.10	5.93	72.20	7.97	0.944
	Not selected	59.31	11.90	56.78	12.49	<0.001#
	Participated but not selected	66.15	8.20	65.01	9.02	<0.001*
	Topper nonparticipants	76.48	4.19	70.00	6.63	0.002*
Combined	Participants	61.60	7.99	64.77	8.14	<0.001*
	Nonparticipants	51.06	11.72	54.35	11.89	0.001#
	Selected	67.92	6.96	71.99	7.31	0.050*
	Not selected	52.83	11.73	56.08	11.85	<0.001#
	Participated but not selected	60.83	7.78	63.89	7.83	<0.001*
	Topper nonparticipants	72.90	2.52	67.95	8.20	0.017*

\* $P < 0.05$  by Paired  $t$ -test, # $P < 0.05$  by Wilcoxon signed-rank test



**Figure 1: Number of students in individual groups as defined in the methodology**

selected students and topper nonparticipants with selected students.

### Statistics

Descriptive statistics were applied to all the data using Microsoft Excel and IMB SPSS v25. Unpaired and paired  $t$ -test, Mann–Whitney  $U$ -test, and Wilcoxon Signed-rank test were applied for between the group analysis.  $P < 0.05$  was considered as statistically significant.

## RESULTS

Data of a total of 728 students was analyzed in the study.

Out of 728 students, 581 were nonparticipants, 147 students participated in the quiz training, and out of these 131 had participated but were not selected for the final quiz [Figure 1]. A total of 16 students got selected in 4 years of quiz, i.e., four students per year; thus, 16 toppers from non-participant group were chosen for the comparison.

A total of 712 students were not selected (combination of non-participants [ $n = 581$ ] and participated but not selected [ $n = 131$ ]). Sixteen topper non-participant students were selected from non-participant group who had highest marks at the baselines (i.e., average of 1<sup>st</sup> and 2<sup>nd</sup> term exams).

Percentage marks of participants when compared to non-participants were significantly different ( $P < 0.05$ ) for theory and practical at baseline (1<sup>st</sup> and 2<sup>nd</sup> term) and 3<sup>rd</sup> term [Table 1]. Similar association was seen between selected and non-selected students and between selected and participated but not selected students.

Baseline marks in theory of selected students were significantly higher ( $P < 0.05$ ) compared to topper non-participants. However, the same difference was not statistically significant ( $P > 0.05$ ) in the 3<sup>rd</sup> term theory exam.

Baseline marks in practical of topper non-participants were significantly higher ( $P < 0.05$ ) compared to selected students but the difference was not significantly different ( $P > 0.05$ ) in 3<sup>rd</sup> term practical marks.

Combined baseline theory and practical marks of topper nonparticipants were significantly higher ( $P < 0.05$ ) compared to selected students, but in 3<sup>rd</sup> term the same difference was not statistically significant ( $P > 0.05$ ).

On paired data analysis [Table 2] between average marks of 1<sup>st</sup> and 2<sup>nd</sup> term with prelim exam marks it was found that there was a statistically significant ( $P < 0.05$ ) increase in

theory marks of participators, non-participators, selected, not selected, and participated but not selected students. Combined marks of participators, non-participators, selected, not selected, and participated but not selected students to increased in prelim compared to 1<sup>st</sup> and 2<sup>nd</sup> term marks. In practical exams, there was a significant decrease in marks of nonparticipators, not selected, and participated but not selected and topper nonparticipators. There was no difference in marks between the 1<sup>st</sup> and 2<sup>nd</sup> term and prelim exam for participators and selected students. There was no difference in theory marks of topper nonparticipators, and practical marks of participators and selected students.

## DISCUSSION

This study was planned to find an association of training in pharmacology quiz on the performance of the students in 2<sup>nd</sup>-year MBBS exams.

It was found that theory, practical, and combined marks of participators and selected students were higher than nonparticipators and not selected students, respectively.

At baseline theory marks of selected students were higher than the topper nonparticipators but in 3<sup>rd</sup> term the difference was not significant. Practical marks of topper nonparticipators were higher than the selected students at baseline which in 3<sup>rd</sup> term became not significantly different. Similarly, combine marks of topper nonparticipators was higher than the selected students at baseline, but in 3<sup>rd</sup> term the difference was not significant. This shows that participating and getting selected in the quiz have a positive impact on the practical and combined marks of the students and scores become better at the end of 3<sup>rd</sup> term exam.

Quiz based learning involves additional training apart from traditional teaching methods. Quiz training involves much more extensive reading, understanding deeper concepts of pharmacology, variant reading including case based, crossword solving, dose calculation, match the following, true or false, structure–activity relationship, drug discovery in terms of origins of medicines, and history of pharmacology. All these combined leads to improvement in student's understanding and interest in pharmacology.

The reason for the improvement in marks of the students at the end of 3<sup>rd</sup> term exam maybe because of better understanding of the subject and increasing efforts by the students, which can make them achieve more in final university examination. Selected students are highly motivated and already good in the exams as seen in their baseline scores. Hence, the reason for the less mean

difference in the scores of selected students could be that improvement in scores of good students is more difficult than improvement in marks of average students. Reduction in marks of topper non-participators could be due to their learning only through traditional lecture methods which may not be enough to improve or even maintain their already good scores.

A study indicated that quizzes could serve as collaborative/cooperative learning methods. Such sessions during scientific conferences not only entertain the participants by engaging them but they also help participants brush up on their knowledge, improve recall of information, and prompt participants to learn.<sup>[1]</sup>

In a 2013 study by Zamini *et al.* study it was found that taking frequent quizzes is not associated with higher final scores than regular training techniques. Previous studies have shown that the effects of frequent examinations and quizzes on science teaching and learning can have favorable effects in the earlier detection of the students' errors and in raising and maintaining high standards of learning attainment. Quizzes and assignments, as teaching aid equipment, can provide appropriate feedback and error correction for students during educational courses. The quiz is a tool for encouraging and monitoring the progress of students, especially when they are taken frequently. It may also have desirable effects such as improving academic achievement, reducing anxiety, augmenting the student-professor communication, and decreasing the study time for the final exam. Conversely, in some cases, it can increase the students' anxiety, and in other cases may have poor or negative effects on the learner's performance.<sup>[2]</sup>

A 2013 study on Iranian Dentistry students showed that scores of the final examinations were significantly higher among students in the quiz group and the combination method of teaching compared to the traditional lecture method group.<sup>[4]</sup>

There are studies which have shown that quizzes have no effect on the student's performance. Harter and Harter in a 2014 study found that adding online quizzes in a semester long introductory economics course did not increase student performance on multiple-choice questions on the final exam nor did it increase students' overall course grades.<sup>[5,6]</sup> This is contradictory to what we found in the study. This can be a possibility as there are multiple factors playing role in final mark score.

A 2013 study by Orr and Foster concluded that students who take pre-exam quizzes tend to be more successful in exams and students of all abilities benefit from participating in pre-exam quizzing.<sup>[7]</sup> Another 2013 study indicated that quizzes

could serve as collaborative/cooperative learning methods and quizzes during conferences would entertain participants, brush up their knowledge, and prompt them to learn.<sup>[1]</sup>

In a study done on nursing students, pre-test results showed no significant difference in their achievement scores. However, in the immediate achievement post-test and the retention test, the students in the quiz group scored significantly better than those in the lecture group. A satisfaction questionnaire showed that the game format was well liked and accepted by students as a more satisfying teaching method.<sup>[8]</sup> A pre-lecture quiz also leads to more questions asked by the students and increase in number of students who come in the class reading the study material.<sup>[9]</sup> Approximately a third of high- and medium-performing students and one-fifth of low-performing students can make large improvements in their exam grades with quizzes.<sup>[10]</sup> The formative online quizzes did enhance summative exam performance and that the online quizzes were valid predictors of exam performance.<sup>[11]</sup> Students who elect to use online quizzes performed better in summative examinations.<sup>[12]</sup> Puzzle-based pedagogy, when compared to traditional lecture-based teaching, can effectively enhance the performance of students on standard course-specific assessments, even when the assessments only test a limited conceptual understanding of the material.<sup>[3]</sup>

Limitations of our study are that we were not able to analyze data of one batch of students due to unavailability of the complete data, which could have made our study findings more robust due to larger sample size. As it was a retrospective study, many factors influencing the scores could not be studied.

## CONCLUSION

Quiz based training in pharmacology enhances performance. This can be one of the methods for teaching pharmacology.

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