

# Evaluation of Peers, in Short Physiological Reasoning Questions, as a Tool for Academic Self Improvement amongst First Year Medical Undergraduates!

Anita Sidharthan<sup>1</sup>, Karthika M<sup>2</sup>

## ABSTRACT

**Introduction:** Physiology seems generally difficult and so less interesting for medical undergraduates. New strategies are required for students to realise defects and to improve learning and answering. This study assess the role of guided *Evaluation of their Peers*, using short Physiological reasoning questions, in enabling academic self improvement, amongst first year medical undergraduates.

**Material and Methods:** This educational interventional study had 6 Pretest sessions, each with 5 short Physiological reasoning questions, from prior informed systems. Each Pretest had 2 subgroups; Direct and After Referring. For Pretest-After refer sessions, from prior provided list of 10 questions, for referring and learning answers, 5 questions were given as test. Pretest-Direct sessions had different 5 questions, from same systems. After test, along with discussion by investigator, using provided answer key, main points, marks distribution were stressed. Students evaluated their nearby peer's paper, faced dilemma of evaluator, finally got back own paper, saw missed points and realised mistakes. Finally 2 PostTest sessions each of 10 reasoning questions picked up from prior Pretests, taking half portions was conducted, evaluated by investigator alone. Also quiz type Competition of same participants as 2 teams, each discussed and presented answers and opposite team awarded marks.

**Results:** Mean scores of students as evaluator were higher compared to teacher in most sessions. No significant expected improvement was seen in scores of Pretest- After referring compared to Direct sessions (N=57) by Paired T test, since they had not referred portions. Scores awarded by investigator showed significant improvement from both PreTest-Direct and PreTest-After refer subgroups, when compared with both Post Tests and Competitions (N=8) respectively, P<0.01, by Paired T test.

**Conclusion:** Making students evaluators for their peers, enables realisation of shortcomings in answering of peers and is a tool enabling significant improvement in learning and answering content of genuinely interested students. Peer participation in active learning, like in competition session of this study, can be the promising better solution for expected academic excellence for newer generation medical graduates.

**Keywords:** Peer Evaluation, Physiological Reasoning, Guided Evaluation, Pretest-Direct, Pretest-After Refer, Post Test, Academic Improvement

(5marks each), 5 short notes (3 marks each), 2 diagrams (2½ marks each) and 5 reasoning questions (2 marks each). The reasoning questions (20% of total marks), offer an opportunity to score almost full marks as these are more objective type, requiring sequential presentation of specific reasons explained in 3-4 sentences. But contrarily here majority score less, generally write 1-2 incomplete sentences from which examiner has to guess. Somehow either adequate learning and understanding and/or its complete and sequential presentation is hindered.

As first year Medical students enter a totally different new professional course, they face a difficult challenge of managing hostel life, choosing books and scheduling routines, extracting maximum time for learning. Adding to their woes uncovered portions from 3 subjects pile up daily. Generally Physiology seems more difficult for students. Habitually they cover subject/topics nearest to a given deadline; which may be test/seminar/viva/dissection.

As predictable when routine first of 3 sessional exams approaches, in the limited time, students rely on thinner coverable, guide type books and majority read only selected important topics. Unfortunately this yields them per 50% marks, usually below and there is a lack of proper understanding due to non formation of basic concepts, which requires reading a detailed textbook itself; a time consuming process.

By opting for guide like books students cover few extra portions in the limited time.<sup>1</sup> But during exams, surprisingly, generally they finish before stipulated time. General complaint on receiving valued answer papers is "I have written but marks given are less in Physiology". Its more problematic as they would have been high scorers in school and consider Physiology as difficult as effort and outcomes don't match.<sup>2</sup>

In first sessional Physiology exam of 2016 batch (n=150) 29.3% scored above 50%. This study is an initiative directed

<sup>1</sup>Assistant Professor, Department of Physiology, <sup>2</sup>Assistant Professor, Department of Community Medicine, Government T.D. Medical College, Alappuzha, India

**Corresponding author:** Dr. Anita Sidharthan, Assistant Professor, Department of Physiology, Government T.D. Medical College, Alappuzha -688005, India

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## INTRODUCTION

The Physiology university examination for first year MBBS consists of two papers each of total 50 marks, comprising a general pattern of 1 Long essay (10marks), 2 short essays

to bring an improvement in the performance of students, especially for the remaining 70.7%. Now routine teacher-centered lectures ensure only an organized base of required minimum knowledge. Enabling achievement of learning objectives requires more active learning, instead of purely memorizing.<sup>3</sup>

*Blended learning* is the hallmark of current change in teaching or specifically facilitation of learning to achieve learning objectives.<sup>4</sup> Vertical and horizontal integration of selected topics is also a step complementing conventional teaching to harness the interest of students.<sup>5</sup> Even supplementation of routine didactic lectures, reinforces and provides a chance for academic improvement in interested students.<sup>1</sup> It is of course a disadvantage that when a lecture for 150 students is taken, it is impossible to ascertain the exact individual lacunae in understanding. Small groups of 15-25 are thus preferable for interactive sessions. This may improve understanding and communication skills, as students also ask questions and discuss.<sup>6</sup> Peers can innovate with their approach of discussing a topic. Active participation of *Peers* is a proven method of academic improvement.<sup>7</sup>

This study attempts to make students, step into the shoes of examiners, with a provided outline of answer key. Making them realise shortcomings in answers of their peers and thus even in their own answer content. This will finally help students upgrade the content and presentation of their answers, be it written or oral.

It is utmost essential that each student is motivated enough to have interest and put in his/her side of required effort to cover specified portions during study. Physiology being basis of Medicine, its good understanding is essential for good clinical correlation in future.

## MATERIAL AND METHODS

This educational interventional study of 1 year duration had clearances by Institutional Research Committee - Protocol no: S30/2016 dated 29/11/2016 and Institutional Ethics Committee - EC 51/2016 dated 29/11/2016. Principal's prior permission was taken as project involved participation of students; order no: B6/12948/2016/GTDMCA dated 5/12/2016. First year MBBS students of 2016 batch at Govt.T.D.Medical College, Alappuzha, Kerala who willingly gave written consent were included.

This study had 2 main groups PreTest and PostTest. Six Pretest sessions were planned each with 5 short Physiological reasoning questions of 2 marks each, from prior informed systems, divided as following sessions: I-General Physiology and Haematology, II-Nerve Muscle Physiology and Gastro Intestinal System, III-Respiratory and Renal system, IV-Cardiovascular system, V-Endocrine and Reproductive system and VI-Nervous system and Special senses.

According to sequence of completion of respective systems in the routine theory hours, these sessions were held, after 4pm in demonstration hall or Lecture hall. In this novel study students had to write test and evaluate paper of any of their nearby sitting peer, with help of marks distribution and outline of key provided. Initial few sessions were held

for small specified 25 roll numbers; for better monitored evaluation. Unfortunately only few participated (Reasons cited by them were late timing, tiredness, immediate other tests/seminars and also cultural competitions). Inspiringly some willing students complained being unaware of this, they were unable to attend. Thus sessions were revamped, opened to all 150 students, as many had requested, though the participation was restricted at 20-25 numbers. Sessions I and II were reconducted with different set of questions to ensure coverage of those portions for participants. Students were informed 1week prior about specific systems for reasoning question sessions, so that they read and refresh. Each of Pretest sessions had 2 subgroups; Direct and After Referring.

For Pretest-Direct sessions, participants faced 5 questions, maybe new or known to them from previous exams. For Pretest-After referring sessions, they were intimated that 5 questions would be given as test from prior provided list of 10 questions; to encourage active learning by students as, 50% of test questions were provided. This also allowed students to assess the learnt areas/ points and concepts, if it were correct, adequate and in sequence for a good answer. Sample of test questions for session IV given in Table 1.

Printed question paper with space for answering in 3-4 sentences was provided, to prevent unnecessarily lengthy answers. Once completed in 10 min, answer papers were exchanged with nearby peer.

The key was discussed by investigator, split up of marks for the important key points were stressed. Along with the guidance of discussion, few handouts, students evaluated and put marks. Guidance of answer key was essential to maintain uniform criteria and prevent bias as students value each other's paper. Print out of key was provided to those who wanted. Valued papers were finally returned to the corresponding students, to be clear about evaluation of own answers, learn missed points, realise mistakes made, to improve understanding and required sequence of presenting of even a brief answer.

All the papers were finally collected back and later

Pretest- Direct	IV. CardioVascular System
1. In chemoreceptor reflex mechanism heart rate is increased.	
2. Effect of exercise on blood vessels.	
3. Digoxin in heart failure.	
4. Sinus arrhythmia.	
5. Arterioles are the seat of peripheral resistance.	
Pretest- After referring	
1. Fainting on prolonged standing.	
2. SA node is pacemaker of human heart.	
3. Korotkoff sounds during measurement of blood pressure.	
4. Cardiac muscle acts like a functional syncytium.	
5. ST segment is isoelectric.	
<b>Table-1:</b> Sample of one Pretest Session- no: IV conducted for Cardiovascular system, the 5 Physiological reasoning questions each which were given as PreTest – Direct and Pretest -After Refer	

scrutinised by principal investigator. Both marks; put by Teacher and Student as evaluator were tabulated. Feedback was regularly taken. Any clarifications regarding key were taken up immediately. All effort was made to complete each session in time; 30min for discussion, with simultaneous evaluation, 10 min for finally assessing own paper evaluated by peer. Mild refreshment was provided to students from project funding itself.

Representatives of batch conveyed schedules, date, time and topic for discussion to their batch.

After completion of all Pretest sessions, 2 Post tests were conducted, dividing all systems covered into two halves; Post test-1 for session I,II,III and Post test-2 for session IV,V,VI.

Both Post tests conducted on same day had 10 questions each, evaluated by investigator alone. Students were informed at short notice that all questions would be picked up from the conducted PreTests itself. Purpose was to encourage, reinforce learnt topics and also to assess if there was any improvement in learning and writing. This was followed by a surprise open quiz type Competition dividing Post test participants into 2 teams. From PostTests, randomly selected 10 questions were asked, successively, by turns, to each team. On turn, after discussing for 2min, one team member would stand up and answer. Each student could present answers only once; to encourage more intra group participation The opposite team then awarded marks. For any deductions in marks out of 2, the reasons/correct answers, wrong /missed points had to be specified. Peers of opposite group listened very keenly, and surprisingly caught even small mistakes and reduced marks. There was a lot of enriching and wholesome discussion amongst group members. This was the most enthusiastic part of study. Winning team was rewarded for encouragement.

## STATISTICAL ANALYSIS

Marks secured by all students in all sessions were documented and routinely feedback was taken. Data were entered, coded in excel sheet and analysed using SPSS software version 16. Significant differences between Pretest- Direct and Pretest-After referring subgroups and comparison for improvement with Post test and Competition were done using Paired T test, 95% CI confidence interval.

## RESULTS

The initial 4 sessions PreTest-Direct I,II,IV and After Refer IV (n=9,5,6,20) were inadequate for genuine comparisons; as different students came for different sessions; there were no corresponding Direct and After refer scores, limitation of 25 roll numbers in inclusion criteria and less participants.

From rescheduled (open to all 150 students) sessions, PreTests - I,II,III,V and VI each had different number of participants (n=18,17,11,21 and 23 respectively). For each student, corresponding scores of PreTest-Direct and PreTest-After Referring subgroups were obtained (5x2=10marks) with each having two evaluation scores by student evaluator and investigator/teacher.

There was no statistically significant difference, in majority

of individual sessions, between scores of Pretests- Direct and After Refer subgroups, whether given by teacher or student. The exceptions were- significant differences seen between scores of Teacher and Student for Pretest Sessions; IV initial After Refer, III Direct, I After Refer, VI Direct and VI After Refer with  $P < 0.01$ ,  $P = 0.033$ ,  $0.007$ ,  $0.001$  and  $0.001$  respectively. Also significant improvement was seen from PreTest-Direct to PreTest-After Refer subgroup, scores given by student in Session IV Initial,  $P = 0.007$  and session II scores given by Teacher  $P = 0.045$ , by paired T test.

For overall comparison, the marks of all sessions Pretest -Direct (D) and After referring (AR) of each student given by both Teacher (T) and Student (S) were compiled in order (n=57). This included students who had attended only few sessions. Unfortunately none had attended all sessions. The mean subgroup scores given by Teacher and Student for Pretest- Direct were 2.3 and 2.8 while for Pretest -After Referring they were 2.5 and 3.1 respectively. Even tabulating all values for each student, including multiple sessions (112 values) shows scores given by Student are significantly higher in comparison to Teacher,  $P < 0.01$  by Paired T test, for both Pretest-Direct and PreTest-After refer sessions.

For final two Post test and competition sessions, participation was quite low (n=8). Post tests (10 x 2=20 marks each) were evaluated by investigator alone as it was time consuming, also these were already discussed, evaluated and learnt by participants in Pretest sessions. Marks secured for Pre tests were taken as baseline value and compared with Posttest scores. Within Pretest group, from Direct to After referring subgroup it was expected that performance would show improvement as students should have actively looked up answers. But a significant improvement was not seen  $P = 0.554$ , using Paired t test.

Scores of teacher and student were not significantly different in Pretest Direct ( $P = 0.660$ ) and After refer subgroups ( $P = 0.868$ ) by paired T test. This is a good indicator that these interested students had valued genuinely according to outline of key provided.

Significant improvement was seen in performance of both Post test and Competition sessions,  $P$  values are given in Table-2. Also communication skills improved with oral presentation.

In Physiology first sessional exam of first year MBBS students (n=150), 70.66% (106) scored below 50% and 29.3% (44) scored above 50%. As intended more of below average scorers from 70.66%, had participated in this study (N=57; Females F= 39, Males M=18). Out of them 59.6% (N=34; F=20, M=14) were below average and 40.3% (N=23; F=19, M=4) were above average scorers in study. There is inadequate decline in number of below average performers. Though female participants were more in study, there was no statistically significant gender difference in their performance in first sessional exam ( $P = 0.058$  by Chi-square test). None in Pretest -Direct subgroup and only 1 (male) in Pretest -After refer subgroup had scored Above 50%. While in Post test, 5 students (F=4, M=1) and all in Competition (F=7, M=1) had scored above average; but after discussion

within their groups.

Compile of the responses obtained as feedback after each session, from all students, including multiple responses, regarding usefulness of study and any other suggestions for improving study, given in Table 3.

An overview of their patterns of reading and preferences for books shows, majority of students (49) admitted to not reading textbooks for session. Of the given list of questions for referring, few students who actually looked up answers were 1,1,3,7,4,7,9,2 and 2 students for 1,2,3,4,5,6,7,8 and 9 number of questions respectively. Notes were not referred for sessions by 48 students, though 40 did take down class notes. Only 13 students generally read notes, 4 preferred self notes, 3 preferred both class and self notes and 4 took notes only sometimes.

Feedback from a cross section of 23 participants in a session showed - for them most difficult subject was Physiology for 3 and Anatomy for 1 student. Gradation of difficulty amongst 3 subjects Anatomy A, Physiology P and Biochemistry B was P>A>B for 8, P>B>A for 4, A>P>B for 4, B>P>A for 2, B>A>P for 1 student. Most difficult system was Nervous system for 17, Endocrine system for 4 and Gastro intestinal system for 1 student. Preferred audiovisual aid for lectures was mentioned as powerpoint for 18 and black board for 6 students.

Feedback of Post test participants showed -evaluation of peer's paper was helpful for 7 and was not helpful for 1 student. They got an idea of marks distribution-2, got to know how to answer reasoning questions and points to be included- 3, realised common mistakes and difficulty in marking-1. Also 6 participants wanted the study to be

extended to other topics; 2 each for nervous system and nerve muscle Physiology, 1 for covering most important topics and 1 for rest of portions. All 8 admitted they realised the shortcomings in their answers and were confident to apply this understanding to larger questions also. Small group discussions were preferred- by 2 students, the upper limit suggested for group was -5,10 and 12 participants by 4, 2 and 1 student respectively.

Feedback regarding competition and study is as given in Table 4. Modifications suggested for improving sessions so that they are more beneficial to participants, were nil by 7 and to discuss more by 1 participant. The most difficult subject for them was Physiology for 5, Biochemistry for 2 and Anatomy for 1 student. In Physiology the most difficult system was Nervous system for 5, Nerve Muscle Physiology, Cardiovascular and Endocrine systems for 1 participant each.

**DISCUSSION**

Generally students fail to realise that marks are awarded only for what is present in black and white on answer papers

		Mean	SD	P value
Pair 1	Direct Teacher	3.162	1.2153	0.554
	Refer Teacher	2.925	.9706	
Pair 2	Direct Teacher	3.162	1.2153	0.000
	Post test	5.425	1.1374	
Pair 3	Direct Teacher	3.162	1.2153	0.000
	Competition	8.512	1.4159	
Pair 4	Refer Teacher	2.925	.9706	0.001
	Post test	5.425	1.1374	
Pair 5	Refer Teacher	2.925	.9706	0.000
	Competition	8.512	1.4159	
Pair 6	Direct Teacher	3.162	1.2153	0.660
	Direct Student	3.262	1.2023	
Pair 7	Refer Teacher	2.925	.9706	0.868
	Refer Student	2.950	1.2862	
Pair 8	Post test	5.425	1.1374	0.000
	Competition	8.512	1.4159	

**Table-2:** Paired T test comparing scores of Pretest- Direct (Direct) and Pretest -After refer (Refer) (n=8) shows no significant improvement in scores given by Teacher. But there is improvement in performance of students in both Post test and Competition sessions (P< 0.01) when compared with PreTest sessions both Direct and After refer. There is no difference between evaluation scores of Teacher and Student, indicating genuine student evaluation. Mean scores and standard deviation SD also reflect the higher scores in Competition and Posttest sessions.

Usefulness of study
Very useful for exams-3
Useful-9
Know how to answer, all the points, marks distribution-23
Understood mistakes, missed points-2
Studied answers to questions which were not known -19
Gain information, knowledge-8
Revised topics-7
Discussion before and after test required-1
Got to know specific answers A to imp questions Q from unit-10
Good discussion-6
Studied 15 question not in selection book-1
Clinical based questions are more useful-1
Suggestions regarding modifications for benefit of students
Nil-37
Satisfied, useful, beneficial, good-9
Best, no need for improvement, already good-4
More questions can be included -11
More time for discussion-6
Make it compulsory for all -5
Teach more question, points, concepts-2
Better if we read and come-2
Feedback of previous result can be given-1
Ask students to make booklet with all Q and A discussed-4
Revise previous session questions-1
Give Q with A beforehand-5
Common discussion class then exam is more useful-1
Little bit slower discussion-1
More specific small topics to study well-1
Preview of class, half hour test, then class-1
Some explanation in local language(Malayalam) to catch up-1
Initial discussion among students, then test-1
Simplified explanation of topics-1

**Table-3:** Feedback of all students (n=57) who attended various sessions compiled, including multiple responses, regarding usefulness of the study and suggestions for any modifications to make the study more beneficial for students.

<b>Competition feedback (n=8)</b>
Thrilling discussion
Interesting
Very useful-2
More helpful than Q and A
Useful
More effective to understand
<b>Rating of study</b>
Useful-2
Very useful-6
<b>Table-4:</b> Feedback regarding Competition session and the rating of study taken after PostTest and Competition sessions (n=8).

for theory. One reason why majority students of present batches finish theory exams earlier than stipulated time, is because they fail to explain even small concepts that they know, in a systematic manner. Often answers start with an abrupt "it", "they". It is taken for granted that examiners will read between lines. It is of utmost importance to make them realise that ideas have to be conveyed sequentially so that it becomes obvious that student knows the answer.

Placing students in the shoes of examiner, provides an opportunity to facilitate this learning. From split up of marks, they could learn presentation of specific key points and explanations are essential to award marks. Applying this they can improve scores and may then start finding Physiology interesting and easy.

In most sessions, student as examiner awarded more marks indicating that students were more liberal and may have failed to get the importance of key points and their explanation or sequential presentation or possibly they did not generally want the problem of facing low scores for either their peers or themselves. In contrast teacher wanted students to improve and enrich answers with points, explanations and order of presentation. This ensures justice to all those who have read and put in effort to learn, improve their understanding and writing. Only in keenly interested minimal participants of Post test sessions, comparison of prior Pretests indicate almost similar evaluation scores as Teacher.

The lower than expected participation of students coupled with their inability to cover specified portions were really quite discouraging. It was expected that a student who had already read / discussed and understood a portion, should do better in same topic and thus improve scores. But there was a decline in participation for post test. Reasons were many-busy schedule, stress of intermittent exams and immediate cultural competition and final sessional exams. Always there was an inhibition towards marks being awarded though it was specified that it would not be taken for official purposes and individual confidentiality would be maintained.

Also more active learning, in Pretest-After refer compared to Pretest-Direct subgroup should have been very beneficial, but this was not seen as majority students had not prepared and read up specified portions for discussion (as per their own feedback). So this lack of improvement was expected; as for both subgroups the topics/ questions were unclear portions

and in effect equivalent to a Direct Pretest. Exceptions were Pre Test, sessions- II by teacher, IV initial by student ( $P=0.045$  and  $0.007$ , paired T test). Student feedback reveals they are aware that reading prior was essential to improve learning.

Picking up already discussed questions from PreTest for the conduct of PostTest and Competition sessions, was an attempt to see the improvement in scoring of students. Unfortunately this was significant but only in those few who attended. Scores awarded by teacher showed significant improvement from PreTest-Direct and *PreTest-After refer* subgroups with both Post Test and Competition sequentially ( $P<0.01$ ,  $P<0.01$ ,  $P=0.001$  and  $P<0.01$  respectively, by Paired T test). Competitions are generally inspiring for students and peers discussions more interesting. United as a team in competition they were able to assemble almost all key points and explanations. Even the process of discussion followed by standing up and saying the answers in competition session moulded their communication skills. Repetitions with post test and healthy competitions involving peer discussions add to blended approach of this study.

This study was useful in significantly improving learning and answering of short theory answers in Physiology for only a small group. Hopefully they will be able to extrapolate systematic explanation learnt in these short questions, to long questions with more marks and thus improve their academic performance.

**Constraints of study:** All below average scorers of 1<sup>st</sup> sessional exam did not attend sessions as expected so it was a lost opportunity to bring an improvement in them. Comparison of effectiveness of academic improvement could not be authentically proved as most of PreTest participants did not attend Post test session. Whatever the reason for dropouts, only if there is interest and persistent effort from student side they would get benefit.

## CONCLUSION

Making students the examiners for their peers is a good tool for significant improvement in their own academic performance. Evaluation under guidance, in the form of discussion with provided key, which stressed the importance of all key points makes students responsible evaluators, enables them to improve their own answering content. Peer participation in active learning can be the promising better solution for expected academic excellence for new generation medical graduates.

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