

# Effectiveness of Supplementing Didactic Lectures in Cardiovascular Physiology with Intermittent Sessions of Discussions in Improving Academic Performance

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## ABSTRACT

**Introduction:** Medical undergraduate students condemn Human Physiology as 'hard'. Routine didactic lectures are insufficient for adequate learning outcomes in all students with varying preferences for methods and durations of learning. This study evaluates the effectiveness of supplementing didactic lectures in improving academic performance of students.

**Material and Methods:** In this educational intervention study the routine lectures in CardioVascular Physiology were supplemented with intermittent sessions of discussions for willing students of first year medical (n=77) and Bachelor Cardio Vascular Technology course (n=10) students. Case histories, diagrams, videos and / graphs were used for discussing 6 topics. Assessment of effectiveness was done by 10 Multiple Choice Questions given as Pretest and Posttest for each of 6 discussion sessions. An interview was conducted for same topics, with slightly different questions, to assess deeper understanding for those who attended all sessions (n=41). Stress levels were assessed using Perceived Stress Questionnaire PSQ and scored by adding responses of 30 items on Likert scale. Statistical analysis was done using SPSS 16.

**Results:** There is a statistically significant improvement in mean percentage scores of Posttest (76.73%, 75.8%) compared to Pretest (44.03%, 51.5%) scores of medical and BCVT students ( $P < 0.001$  by paired t test). Stress scores were low for majority and coping measures seemed adequate. Association of post test performance with having a relative in medical field was significant for medical undergraduates (Fischer's test 0.048).

**Conclusion:** Supplementation of didactic lectures with short, interactive, discussion sessions improves academic performance. Better understanding of Physiology will facilitate grooming of better future clinicians. Medical undergraduates have some stress but not significant to affect their academic performance.

**Key words:** didactic lectures, questionnaire, discussion, active learning, stress scores, stress relievers.

In this era of technological advancements it is important to incorporate different teaching methods to rein in the interest of students. So the need to combine passive pedagogical and active andragogical approaches to teaching.<sup>2</sup> Interactive small group discussions encourages students to ask questions, improves understanding and communication skills.<sup>3</sup> A sound language knowledge is important as textbooks are in English.<sup>2</sup> Also a sex-based difference in learning and listening styles is known, with females preferring live lectures to recorded materials.<sup>4,5</sup>

There is no one best way to teach everything to all students. Routine didactic lectures may be insufficient for adequate learning outcomes for all as they differ in their preferred method and duration of learning.

Different methods have been tried previously-For disorders of Gastro Intestinal Tract and Endocrine System, students learnt better with oral presentations and "patient-doctor" role play.<sup>6</sup> For endocrinology Method of Loci (MOL) a mnemonic device to arrange and recollect memorial content facilitated learning.<sup>7</sup> Problem-based learning (PBL) is beneficial to study in depth, find answers to problem situations, have better clinical knowledge and reasoning but coverage of topics was less.<sup>8,9</sup> So the preference for Case-based learning CBL a structured, guided inquiry.<sup>10</sup> Blended Web Based Learning WBL-PBL course with immediate automated marking and feedback improves student performance in same teaching time.<sup>11,12</sup> Interactive Computer-Aided Learning (CAL) via online sites with Face-to-face teaching overcomes time/place constraints of a classroom.<sup>13-16</sup> A horizontally and vertically integrated curriculum provides required knowledge, attitude and skills.<sup>17,18</sup> Even separation of theory and practicals with clearly defined and different learning objectives, leads to better problem-solving skills and understanding.<sup>19</sup>

This study attempts to find the effectiveness of supplementing didactic lectures in sustaining interest of students, facilitating learning thus leading to improved academic performance. Also to find from students itself why they find Physiology *difficult*.

## INTRODUCTION

Of the basic science subjects in first year of medical undergraduate course, students somehow find Physiology "hard" to learn.<sup>1</sup> The paramedical course students have similar opinion. This may be due to, the nature of the discipline and the prior knowledge of student accumulated over schooling years.<sup>1</sup> Immediate changeover from school routine with pedagogical teaching to a hectic professional course, leads to problems in finding individual appropriate methods of coping with daily learning; both theory and practical. Deadlines of exams leads to more memorization and less understanding of concepts. In didactic (routine) lectures, the predominant method of teaching, students are passive. Lack of routine student feedback process leads to a wait till examinations to assess learning.

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## MATERIAL AND METHODS

This pilot study evaluates the effectiveness of supplementing the routine lectures to facilitate learning taking only CardioVascular System for discussion.

Prior clearance was obtained from Institutional Research Committee IRC ( No: B3/1573(A)/2010/ TDMCA dated 06/11/2013) and Institutional Ethics Committee IEC (EC 68/2013, No:B3/1573/2010 /TDMCA dated 28/11/2013) of Govt.T.D.Medical College, Alappuzha, Kerala. Funding of Rs. 39723 was granted by State Board of Medical Research SBMR unit, Govt.T.D.Medical College, Alappuzha, Kerala (order no:A1/4442/2013 G.T.D.M.C.A dtd 9.12.2013 and 26.3.2014 ). This educational intervention study was open to the entire batch of students (MBBS-150 and BCVT-5) as recommended by IRC but was targeted for those requiring academic improvement. As expected the following students who gave a written consent were included- first year medical undergraduates (MBBS students) of 2013 who scored below 50% in first exam (n=72) and supplementary batch students of 2012 (n=5) and Bachelor Cardio Vascular Technology (BCVT) students 2013 (n=5) and 2014 (n=5).

Following questionnaires were used to collect information from students.

**General information questionnaire, Perceived Stress Questionnaire PSQ (for Stress evaluation), Evaluation questionnaires** - Multiple Choice Questions MCQs for 6 selected topics; 1-Cardiac muscle and Conducting system of heart, 2-EKG, 3-Cardiac cycle, 4- Cardiac output, 5-Hemodynamics and functional anatomy of vasculature and 6-Blood pressure.

Each 1hour session started with 10 MCQs given as Pretest, followed by a discussion for the topic with help of few projected diagrams, graphs, videos and/ case based discussions(35min ). Same set of 10 questions was then given as Post test. Both were scored out of 10 marks. Though 77(72 regular +5) MBBS and 10 BCVT students came for initial sessions only 41 MBBS students attended all the sessions and they were individually called later for Interview session. Slightly different questions were asked to assess deeper understanding; took minimum of 40 min for each student.

As study was done in the college Lecture hall after the routine lectures, light refreshment was provided from the project funding. Few students gradually dropped out, citing different reasons -other tests and seminars in between, tiring after routine schedule and other personal inconveniences.

## STATISTICAL ANALYSIS

Data collected were analysed and interpreted using SPSS 16. Paired *t* test was used to find significant difference between mean percentage scores of pretest and post test. To find association between mean percentage post test score and categorical variables (various factors like stress scores, tuition dependence, syllabus studied in school etc) Chi square and Fischer's test was used.

## RESULTS

### General information questionnaire

Majority of medical undergraduates (MBBS) and BCVT students had studied under Kerala State syllabus, had academic support in form of tuitions in X<sup>th</sup> and XII<sup>th</sup> classes(Table-1).

Majority of MBBS students scored above 90% in X<sup>th</sup> and XII<sup>th</sup>. Majority faced the struggle of expected adjustment problems, self management of daily chores and time management as 85.7% MBBS and 100% BCVT students were staying in Hostel.

Premedical entrance - Coaching was specifically taken by 94.8%, exam was cleared in first attempt by 16.9%, in more than 1 attempt by 83.1%, decision of course selection was taken because of Own and/or Parent's interest by 85.7% of MBBS students. While all BCVT students got selection in the first attempt based on XII<sup>th</sup> marks and selection of course was because of own interest for majority.

Ambition of 71.4% MBBS students was to become a good doctor, serve society etc and the rest aimed for Post Graduation, better lifestyle etc. Comparison of first mentioned response shows that majority- aspired to become a good doctor 59.7%, do postgraduation/super speciality 40.3%; thus all were motivated and interested in course. Majority of BCVT students wanted to become good technicians and get good jobs.

Among parents of MBBS students - 48% fathers and 50.6% mothers were- graduates, postgraduates or professionals and majority mothers, irrespective of level of education were housewives (only 25 were employed). Education of parents does influence the interest, awareness and motivation of student regarding a professional course.

Of MBBS students 23.4% had relatives in medical field who could guide them on different aspects of a professional course.

Among parents of BCVT students -5 fathers and 4 mothers were graduates, postgraduates or professionals. All mothers were housewives. Only 2 students had relatives in the medical field.

For evaluation of presence of stress, Perceived Stress Questionnaire PSQ<sup>20</sup> was administered around time of first sessional examination. It was based on subjective perception, emotional, cognitional response of person to a validated list of 30 item questionnaire. Each item/query had to be graded from 1 to 4 on a Likert scale. Items were divided into four factors indicating scales; Factor I – worries (stress reaction), II- tension (perceived stressor), III- joy and IV- demands.

An overall score was calculated from sum of score of all factors with score of the scale "joy" being inversed as it is positively coded. Higher scores indicate more stress.

Scores obtained were divided into the following ranges; 41-50 as Very low, 51-60 as Low, 61-70 as Medium, 71-80 as High, 81-90 as Very High and 91-99 as Extreme Stress.

Majority of students had medium to high stress 46.7% of MBBS and 70% of BCVT. To check for association of stress with academic performance, scores of 41-70 were taken as Low stress and 71-99 as High stress. 70% of BCVT students had Low stress. Similarly majority of MBBS students 61% had Low

	MBBS (n=77)	BCVT(n=10)
State syllabus in X <sup>th</sup>	58.4%	90%
State syllabus in XII <sup>th</sup>	58.4%	100%
Above 90% score in X <sup>th</sup>	74%	30%
Above 90% score in XII <sup>th</sup>	67.5%	50%
Support of tuitions in X <sup>th</sup>	54.5%	50%
Support of tuitions in XII <sup>th</sup>	64.9%	70%

**Table-1:** Percentage of MBBS and BCVT students who studied in state syllabus, scored above 90% and took academic support of tuitions in class X<sup>th</sup> and XII<sup>th</sup>. All are academically good.

stress but exam related stress was mentioned by majority. Taking first mentioned response as major source of stress it was seen-for MBBS students (n= 77) this was Exam related (41) and Inability to cover portions (14) and for BCVT students diversely due to Inability to cover portions, feeling homesick, adjustment problems, radiation exposure concerns in Cathlab etc. Grouping reasons like Inability to cover portions, Exams related, difficulty in Anatomy, Physiology, high expectations all together as Exam stress; this was mentioned by 85.7% of MBBS and 30% BCVT students.

**Stress incident reporting:** There were no specific stress causing incident / incidents reported.

Stress was *relieved* mainly by Talking to parent/ friend or by listening to music in 59.7% MBBS and 80% BCVT students.

**Evaluation questionnaire:** The scores of each student out of 60 was converted to % and values obtained for Pretest and Posttest. Mean % scores were 44.03 and 76.73 for MBBS (n=77) (Table-2) and 51.50 and 75.80 for BCVT (n=10) (Table-3). Comparison by Paired t test using 95% Confidence Intervals shows a highly significant improvement from Pretest to Post test % scores  $P < 0.001$  for both groups. In Interview group (n=41) Pretest, Posttest and Interview mean % scores were 46.41%, 78.71% and 47.56% respectively (Table-5). Statistically significant improvement is seen in post test but not in interview scores. Possibly immediate recall is good but long term retention and in-depth learning is not satisfactory.

Taking above 65% scores as high and below 65 % as low, association of Post test performance was compared with various factors like stress scores, tuition dependence, syllabus studied in school etc, using Chi square or Fischer's test. Significant association was seen only with having a relative in medical field for MBBS group (Fischer's test 0.048).

An informal verbal feedback taken from Interview group (n=41) showed majority took down class notes regularly 65.8%, sometimes by 31.7% and not done by 2.4%. Self notes were not made by 48.7% (because of lack of time and inability to cover portions), sometimes made by 24.3%, only near exam time by 14.6% and regularly made by 12.1%. Habit of reading text was present in 36.5%, text and notes in 41.5% and only near exam time by 14.6%.

Unfortunately majority studied only on verge of exams and mostly from thinner guide type books for rapid coverage of topics. Up-to-date coverage of daily portions taken in lectures was not possible for majority 97.6%. Self study was preferred by majority of students 58.5%, combined study by 19.5%. Only for exams, combined study was done by 4.87%, both self and combined study by 17%. As expected self study seems the most preferred method.

If a topic was not understood, majority just memorized it 39%, some tried reading again 34.1%, 7.3% each; either asked others

or left the topic.

The most difficult topics in CVS for majority were cardiovascular reflexes, BP and shock (31.7%), followed by ECG (24.3%) and then cardiac cycle (21.9%).

The most difficult subject for majority was Physiology 51.2%, followed by Anatomy 34.1% and Biochemistry 12.19%.

All mentioned that initially they had difficulty in managing time. Anatomy being given more time by majority, uncovered portions of other two subjects piled up and could not be covered the week prior to exam when they seriously started reading. There was no definite time plan to cover all portions daily. This lead to dependence on guide like books having question with answer discussed format. With less understanding it was difficult for students to sequentially put together concepts, leading to low academic scores. Unfortunately this lead to lack of confidence, disinterest in the subject and condemnation of Physiology as *difficult*. Few students were unable to find their personal, effective and time efficient method to study.

**Feedback regarding study:** The study was rated as Useful by majority of students. Only 2 responses for '*All reasons for study not being useful*' - show that it was necessary for a student to put his/her effort and have read the portion prior if the discussion was to be a useful supplement.

Majority wanted - small groups for such discussion (< 20) citing better interaction, other systems to be included and extension of such discussions for coming fresh batches of students.

An informal verbal Feedback of entire MBBS batch showed that for majority of first MBBS students the most difficult subject was Physiology (Table-5) and the most difficult system was Nervous system (CNS) (Table-6).

**DISCUSSION**

Physiology the foundation for future better clinicians, requires integrating knowledge from different disciplines (physics, chemistry, biology) and many levels of organization (molecular,

MBBS	Mean	S.D	SEM	P value
Pre test%	44.03	11.373	1.296	< 0.001
Post test%	76.73	10.351	1.180	

**Table-2:** Mean % score, standard deviation and standard error of mean of MBBS (n=77) students in pretest and posttest. Post test performance following discussion shows significant improvement by paired t test with  $P < 0.001$ .

BCVT	Mean	SD	SEM	P value
Pre test%	51.50	15.911	5.032	< 0.001
Post test%	75.80	11.830	3.741	

**Table-3:** Mean % score, standard deviation and standard error of mean of BCVT(n=10) students in pretest and posttest. Post test performance following discussion shows significant improvement by paired t test with  $P < 0.001$ .

Interview n=41	Mean	S.D	SEM	Paired t test	P value
Pretest %	46.41	10.759	1.680	Pre -Posttest	< 0.001
Post test %	78.71	8.116	1.267	Pre -Interview	0.558
Interview %	47.56	14.018	2.189	Post- Interview	< 0.001

**Table-4:** Mean % score in pretest, posttest and interview of the Interview group (n=41) MBBS students who attended all 6 sessions of discussions, with standard deviation and standard error of mean. Last column shows P values obtained by paired t test for Pretest-Posttest, Pretest-Interview and Posttest-Interview. Highly significant improvement is seen in post test performance.



Most difficult subject	Frequency	Percentage
Anatomy	55	38.5
Physiology	71	49.6
Biochemistry	17	11.8

**Table-5:** Most difficult subject for first MBBS students (n=143), from an informal verbal feedback, taken after their Physiology University practical viva voce examination.

Most difficult system	Frequency	Percentage
CNS	95	67.8
Endocrine	14	10
CVS	11	7.8
Respiration	10	7.14
Gastrointestinal	7	5
Renal	2	1.4
Special sense	1	0.7

**Table-6:** Most difficult system in Physiology for first MBBS students (n=143), from an informal verbal feedback, taken after their Physiology University practical viva voce examination.

cellular, organ, organism).<sup>21,22</sup>

Teacher-centered lectures provide a base of organized knowledge, which student should integrate for more active learning.<sup>2</sup> There cannot be a sudden complete shift from the prescribed lectures but supplementation via interactive sessions can bring conceptual and academic improvement in students by facilitating active learning. This is not a novel concept.

As no single method of teaching can ensure thorough understanding, blended learning is need of the hour to rethink the design and delivery of teaching.<sup>11</sup> In the struggle to meet deadlines, gaps in concepts are easier to fill if there is guidance for example from a relative in medical field or maybe discussions disguised in name of tutorial.

Examples of innovative teaching methods are physioquiz, computer-assisted learning, undergraduate projects, seminars, concept mapping by mental models and making models using play dough for ever confusing nervous tracts.<sup>23</sup>

Computerized simulation sustains interest, makes understanding easy,<sup>24</sup> especially in surgical procedures<sup>25</sup> though effectiveness in medical education has been questioned. Only active learning leads to lasting meaningful learning.<sup>26,27</sup> Even articulating explanations to self/peers or discussing doubts with teachers helps. Peertutored discussions are more preferred being interactive and interesting.<sup>28</sup> A problem-based integrated curriculum for CVS had previously showed benefit.<sup>27</sup>

Even in this study supplementary discussions with diagrams/videos/case histories have shown significant immediate improvement in academically interested students as seen in post test scores. But expected improvement in Interview scores is not seen; adequate depth in learning has not been achieved. Possibly smaller groups are required for more interaction. Also time required for a student to assimilate concepts varies and there is no substitute to their spending time with difficult topics, consistent hard work and effective time management.

In the routine schedule itself time can be allotted for refreshing diagrams/ tables discussing cases histories or situations. Student can thus become prepared to interpret different novel case settings.

Academic improvement, in learning and understanding of

Cardiovascular system Physiology is seen with supplementary discussions. But motivation and interest of the student is required to spend time, find cause-reason relations and integrate understanding of physiological mechanisms. Medical undergraduate students face some stress and failure of coping strategies can lead to a spectrum of depressive symptoms.<sup>29</sup> Monitoring and appropriate support system is required for those few unable to cope with stress.<sup>30</sup> Stress amongst medical students, in this study is low for majority and does not have a significant effect on post test performance.

Since the association of post test performance of students was significant only for having a relative in medical field, it shows the importance of guidance in different aspects of medical profession. Teacher can guide the student to the correct route (facilitate learning) but student has to find his/her own way (active learning). It is but hard to distinguish between the independent and dependent variables in Educational research.

This study can be extended to other systems, with more interactive smaller groups.

## CONCLUSION

All medical undergraduates are academically good. Majority have some stress but not significant to affect academic performance; coping measures seemed adequate. Exam related stress can be handled better possibly with better time management, daily coverage of topics and guidance; be it from a relative in medical field or from teacher. There is no alternative to student's own effort, interest, motivation and individualized method to learn. Further studies with smaller groups for better interaction, has to be done to make Human Physiology *easy* for students.

Statistically significant academic improvement is seen by supplementing the routine didactic lectures with short sessions of discussions. Such interactive, sessions will help to fill lacunae in understanding of Physiology, making it interesting, easy and thus facilitate the grooming of better future clinicians.

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