

Active learning in Pharmacology and Therapeutics –Introduction of competition based co-curricular activity

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Abstract

Learning is defined as modification in behavior as a result of exercise, practice or experience. So as to induce active learning in second MBBS Pharmacology students, we tried to introduce a form of competition based co-curricular activities. The activities comprised of an orchestrated design, consisting of microteachings, seminars, quizzes, fish bowl games, Problem based tasks, involvement in Research methodologies. We also chose our comparison criteria as sincerity, recall ability, public speech ability, learning interest, development of psychomotor skills and assessment of cognitive and affective domains. For this developmental research we chose voluntarily willing ten students.

We observed a variable pattern of involvement of students in each activity. Three out of ten students scored more in co-curricular active learning than in traditional internal assessment. 50% willing participants attended and performed in most activities including seminar presentations. While all the ten participants scored more than 35% eligibility criteria in traditional internal assessment, as well in active learning. Active participation by putting in individual's own efforts makes learning more effective and useful. This establishes better correlation of Pharmacological knowledge of drugs with therapeutics. Complicated concepts of Individualized drug therapy and rational use of medicines can be introduced and developed using such methods. Those who are weak in immediate recall activities can be distinctly separated and trained by repeated exposures to immediate recall exercises, problem based learning and research activities. Presentation skill can be improved by repeated exposures to microteaching thus preparing good speakers for future.

Keywords: Continued Medical Education, Problem Based Learning, Research Project, Rational Use of Medicines, Immediate Recall, Psychomotor Domain.

Introduction

Therapeutics means “to treatise” and is the backbone of health care, being second important after final diagnosis. As per curriculum, pharmacology & therapeutics is taught without much linking with clinically relevant practical's. Such training is devoid of development of psychomotor and affective domain. Students feel this as a burden. They read it only for passing examination, by superficial learning process. Active learning in pharmacology and therapeutics is the need of hour.

Learning is defined as modification in behavior as a result of exercise, practice or experience.⁽¹⁾ Acquisition of predetermined desirable behaviors, dealing more with abilities to be achieved is target under active learning. As per theory of meaningful verbal learning, many basic facts of medical sciences have to be presented.⁽²⁾ Learner explores relationship between received elements and deduces strategy to solve problems.⁽³⁾ This is possible by linking surface & deep learning.⁽³⁾

Traditionally in medical schools there is growing dissatisfaction over quality of learning.⁽⁴⁾ It has been found at many instances that, medical teachers in India have not joined the profession for the love of teaching.⁽⁵⁾ In an attitudinal study less specificity and adequacy of knowledge to be gained by learner has been identified.⁽⁶⁾ Change in cognitive structure of learner can be indirectly inferred from ability to think, feel or do the task.⁽⁷⁾

Common entrance examination based admission system for postgraduate courses, has diverted MBBS trainees' interest to gain specific and adequate knowledge. Commercialization of medical education has additional adverse impact.

As per universities, internal assessment has been limited to performance of students in term-ending exams. In Pharmacology subject, there is no experimental exercise to be done by students themselves during practical classes, and examination. This deprives them of development of psychomotor domain.

Present system of internal assessment under Pharmacology syllabus carries a flaw of poor identification of the talent in particular trainee and lack of useful skill development in students. It does not reflect ability of a student to deliver a public speech, to exhibit instant recall, ability to analyze a situation. Their ability to undergo problem solving, to undertake research project, to fix priority out of multiple options in unprecedented situation, all these are not developed. Similarly, their ability to actively participate in group discussion and to deliver speech in public meeting is also untouched. Practical examination exercise is framed from exercises which are spoon-fed to them during their routine curriculum. They write answer in table work format. In practical examination, it is the testing of the conditioning only and not of psychomotor skills. Viva-voce scores are added to theory scores which has its own

drawbacks- of biasness, subjectivity, non-reproducibility.

In view of all above drawbacks in the present education process, we aimed to design and implement a continuous internal assessment programme in small group of volunteer students as a pilot project.

Methodology

We have designed active learning method in the form of competitive co-curricular activity. The activities comprised of an orchestrated design, consisting of microteachings, seminars, quizzes, fish bowl games, Problem based tasks, writing research protocols for submission to ethics committee and ICMR. We also incorporated their attendance in routine teaching activities and their performance in term ending exams.

In this format, consideration of attendance, scores in term ending exams, with performance in other co-curricular activities and academics are given due weightage. When assessment is done in this way, it will reflect development of skill and also will reveal the talent in each student. This can be of great help to learner for deciding his/her future.

Methods

Willing students (n=10) out of 25 of 2012 batch at our medical college underwent active learning exercises on following criteria:

- ❖ **For sincerity** – Record of their attendance in theory, practical, extra and active learning classes.
- ❖ **For developing public speech ability** - Scores in performance activities i.e. Microteaching out of 10, short topic out of 65, and seminar out of 125 marks.
- ❖ **For testing immediate recall ability**- Scores in tutorials out of 10 and Quiz out of 50 marks- to these are added scores in Viva I, II and III of term-ending exams (7+7+14 marks respectively).
- ❖ **For cognitive and psychomotor skill development**– scores out of 180 in terminals theory, out of 92 in practical exams. Internal assessment score calculated out of 15 each for theory and practicals (as per university directives) were compared with active learning scores.
- ❖ **For development of interest** -The scores in class work, homework, rational use of medicines, problem based learning giving them therapeutic problems, analytical skill development by experimental graph exercises, fish bowl task and priority fixation task to test their group dynamism, research methodology, protocol design, protocol approval by ICMR/IEC and its completion / publication, and score in individualized drug therapy exercise. All these were covered as continued medical education (CME) related topics.
- ❖ **For testing psychomotor and affective domain**- Scores in research methodology, protocol submission, approval from either ICMR or institutional ethic committee, completion of project,

publication. All these are included under continued medical education (CME).

The assessment in these aspects was done by one teacher, and formatting was done by other teacher. Total scores in different group of activities were taken as criteria to explore hidden talent in students. Grand total scores were used for purpose of calculating percentage and percentile. Then we compared these percentage/percentiles with internal assessment percentages, scored by existing method (i.e. based on performances in terminal exams). Score of 50% and/or percentile of 70 were considered as passing criteria. At the end, top three scorers were given trophies and certificates for their respective performances. Out of maximum grand total 848 marks, percentage of marks scored can be calculated. Similarly, percentile of each can also be calculated.

The ethical clearance from Institutional ethics committee was waived, as most exercises were curriculum and academics based, without interventional or invasive technique.

The score of each student is tabulated to calculate total score following which percentages can be calculated. (Table 1, 2 & 3) First column includes different heads. Second column shows maximum marks which will be useful in calculating percentage. Third column shows best score which can be utilized for calculating percentile score. Remaining part of table shows scores by each of participants. Last row of table informs about final score of each participant out of total maximum.

Percentage score in traditional method of internal assessment marks (presently out of 15 each for theory and practical's i.e. total 30) is taken separately, with percent and percentile scores in co-curricular activity, for purpose of comparison.

Results

On sincerity criteria: Attendance of participants and of whole batch was less in second term theory as well as in practical's. This was compensated by short topic presentations arranged in third term to fulfill the criteria of minimum required attendance for eligibility to appear in final examination. Graph 1 shows corrected attendance of all to be 100 and more.

On development of public speech ability criteria: Roll no. 1264 and 1291 performed best in presentation activities scoring 135 and above out of 200 marks. Graph 1 shows that five (roll nos. 1213, 1214, 1221, 1223, 1293) scored much less. They presented activity as compulsion in extra classes. Roll no. 1264 who has total score less than other three, is highest scorer in presentation activities.

On immediate recall ability criteria: Roll no. 1211 scored highest in immediate recall, followed by roll no. 1209 (Graph 1, Table 1). Roll no.1291 was weak amongst five top performers.

On cognitive skill development: The scores in terminal examination of roll no. 1209 and 1291 were better than others (Graph 1, 2). None could participate in research project activity.

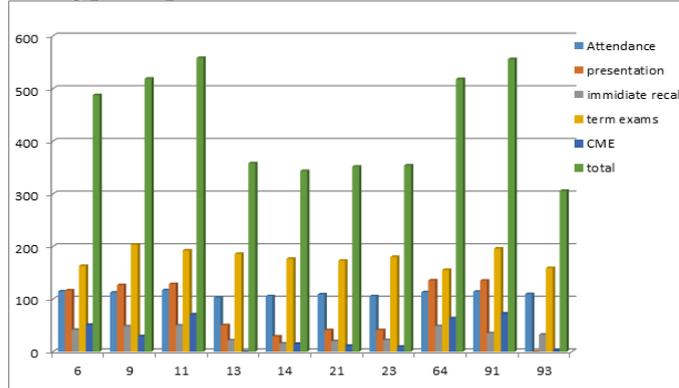
On testing and development of interest criteria: Roll no.1211 attended all activities and was highest scorer. Roll no. 1291 emerged equally good scorer despite absence in a few activities (Table 2, Graph 1).

On psychomotor and affective domain criteria: Three students attended research methodology introductory orientation (Table 2). None of them could submit

research protocol for approval by institutional ethics committee. They proceeded on preparation leave for final examination. These three were advised to design protocol and submit it for approval after undergoing necessary prerequisites.

Table 3 shows that five out of ten have percentile > 70 (Roll no 1206, 1209, 1211, 1264 and 1291). Closely matching percentage was observed in Roll no. 1291. Three (Roll no 1206, 1211 and 1264) out of ten scored more in co-curricular active learning than score in exam based traditional internal assessment.

Graph 1: Showing composite performance, and importance of presentation, immediate recall and CME in willing participants on different heads under active learning



Vertical axis shows final scores out of maximum
Horizontal axis shows roll nos. of participants

Table 1: Scores in immediate recall activities of ten willing participants in co-curricular active learning

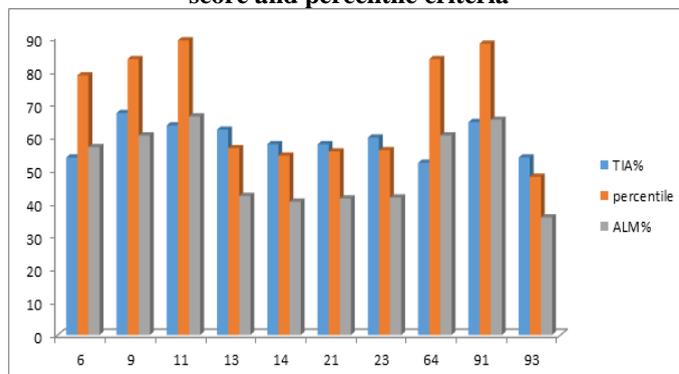
Heads	Max	Best	1206	1209	1211	1213	1214	1221	1223	1264	1291	1293
Tutorials	10	10	2	2	5	0	0	0	0	10	4	0
Quiz	50	25	24.2	24.2	25	0	0	0	0	25	15	15
Viva-i	10	5.5	4	5.5	4	5	4	5	5.5	3	4	4
Viva-ii	10	7.5	3.5	6.5	6.5	7.5	4	6	6.5	3.5	6.5	6
Viva-iii	14	10	8	10	9.5	9	7.5	9	10	7	5.5	7.5
Total	94	58	41.7	48.2	50	21.5	15.5	20	22	48.5	35	32.5

Tutorial scores based on maximum no. of question correctly answered.

Score in quiz derived by equally dividing performance score amongst members in team.

Viva scores are individual performance in term exam viva-voce without negative marks.

Graph 2: Showing comparison between traditional and co-curricular active learning methods on percentage score and percentile criteria



Vertical values show percentages, Horizontal axis shows roll nos.

TIA - traditional internal assessment
 ALM-active learning method (term exams+other activities).

Table 2: Scores of CME topics in co-curricular active learning

Heads	max	Best	1206	1209	1211	1213	1214	1221	1223	1264	1291	1293
RUM	5	5	0	0	5	0	0	0	0	5	5	0
Class-work	26	18.5	8	17.5	13.5	0	0	0	0	10.5	18.5	3
Home Work	30	21	0	0	7.5	0	6	0	0	15	21	0
PBLearn-2	16	7.5	7.5	0	7.5	0	0	0	0	7.5	4	0
PBLearn-1	14	12	11	0	12	0	0	0	0	11	8.7	0
ASD	12	10	6.2	4.5	6.5	0	0	0	0	6	10	0
Fish Bowl	2	2	2	2	2	0	2	2	2	0	0	0
FB-Task	5	5	4	2	5	0	2	4	5	0	0	0
PF	2	2	2	0	2	0	0	0	0	2	0	0
PF-Task	11	5.5	5	3.5	4	0	5	5.2	2.5	3	5.5	0
IDT	5	4	3.5	0	4	0	0	0	0	1.5	0	0
RMO	2	2	2	0	2	0	0	0	0	2	0	0

RUM -Rationale use of medicines,

PBL - problem based learning

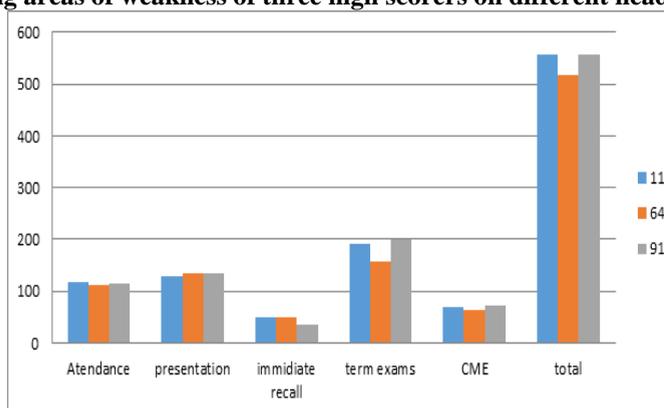
ASD - Analytic skill development

PF - priority fixation

IDT - Individualized drug therapy: Anti-hypertensive drug selection

RMO - research methodology orientation

Graph 3: Showing areas of weakness of three high scorers on different heads in active learning



Vertical axis shows scores in different activities

Table3: Comparison of scores in co-curricular active learning (ALM) vs traditional internal assessment (TIA) method

Heads	1206	1209	1211	1213	1214	1221	1223	1264	1291	1293
ALM %	56.74	60.25	66	41.98	40.24	41.2	41.48	60.25	65	35.5
TIA %	53.6	67	63.3	62	57.6	57.6	59.6	52	64.3	53.6
Percentile	78.4	83.32	89	56.4	54.14	55.44	55.8	83.32	88	47.79

Discussion

Brings et al has already defined instructions, which provide controlled environment to mould learning in pre-decided way.⁽⁸⁾ There are recommendations that a complex task should be broken down into smaller simpler tasks to achieve improvement in teaching learning process.⁽⁹⁾

Continuous internal assessment means, “acquisition of predetermined desirable behaviors, dealing more with

abilities, which cannot be tested in summative evaluation while learner are under continuous observation”.⁽⁹⁾ Such a formative evaluation however should never be taken for final pass/ fail decision.⁽⁹⁾ It is evident from graphs and tables that 50% (five out of ten) willing participants attended and performed in most activities including seminar presentation. In active learning eligibility criteria for appearing in final exam is 50% or 70 percentile. Other students became not eligible due to

non-participation in number of activities. This was because the participation was not given due importance as it has not currently been made mandatory by respective university. While all the ten participants scored more than 35% eligibility criteria in mandatory exam based traditional internal assessment, as well in active learning.

Five out of ten are eligible on percentage and percentile criteria. 40% (Four out of ten) students who participated in most activities, scored more than traditional internal assessment score. Active participation by putting in individuals own efforts makes learning more effective and useful. This establishes better correlation of Pharmacological knowledge of drugs with therapeutics. Concepts of Individualized drug therapy and rational use of medicines can be introduced and developed by framing relevant exercises in CME related part of co-curricular activity in active learning.

Graph 3 shows weak areas of three high scorers. 1291 performed well in terminal examinations, was found to be relatively weak in immediate recall. Similarly Roll no. 1264 was weaker in term exam.

Conclusion

Implementation of continuous internal assessment process is a critical step. Whole of the batch can similarly undergo active learning. The batch can be divided in small batches equally, assigned to separate faculty member teacher to carry out assessment. This will keep all teachers equally engaged in very fruitful and most needed work.

As these students are the clinicians of future, those who are weak in immediate recall activities and CME can be distinctly separated. These can be trained to improve in their weak areas by repeated exposures to immediate recall exercises, problem based learning and research activities. Presentation skill can be improved by repeated exposures to microteaching thus preparing good speakers for future.

Wherein continuous internal assessment has drawback of not useful for final pass/fail decision, active learning can be useful for this and has potential to replace the university exam. When active learning is made mandatory by university, all students will participate in most framed exercises and activities. Above said results of those who attended most activities indicate that there are least chances of adverse impact on learning. There will be great saving of time, money and manpower. Time so saved can be utilized for completion of research projects by students. There will be much reduction in stress/ anxiety which prevails amongst students before and during traditional final examination. Moreover improvement in student teacher relationship is also possible.

Inclusion of active learning method in syllabi/ curricula and change in examination pattern for pharmacology subject can improve effective learning by

keeping students focused on their primary work of learning therapeutics.

To develop interest in teachers, such types of activities can be accredited with credit hours by regional and/ or national medical council. This will save them from getting engaged in workshops which are of no utility for undergraduate students training purposes.

Limitations

Biased and disintegrated attitude of teachers as faculty members may cause adverse impression in learner students.

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