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INTRODUCTION OF INTEGRATED TEACHING AND ITS COMPARISON WITH OTHER TEACHING METHODS IN PHARMACOLOGY FOR UNDER GRADUATES

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ABSTRACT

Background and Purpose: Integrated teaching is new in pharmacology. In the present study, evaluation and comparison of integrated teaching, conventional theory teaching and tutorial has been done.

Material and methods: Ten pre and post tests were conducted each for integrated teaching, theory class and tutorial for 126 students. Student's attitude towards these teaching methods and bedside clinical teaching were analysed.

Results: There was significant improvement in post test scores when compared with pre test scores in all three types of teachings. When post and pre test's differences were compared, conventional theory teaching was significantly effective than integrated teaching which in turn was significantly effective than tutorial. Student's attitude tests revealed merits and demerits of theory class, tutorial, integrated teaching and bedside clinical teaching.

Conclusion: Integrated teaching will promote active learning. Conventional theory and tutorial classes are popular due to their easiness in acquiring and consolidation of the knowledge respectively. These findings will help in further educational research.

INTRODUCTION: India consists of more than 314 medical schools, each affiliated to a university, produces about 30,000 doctors each year making Indian medical education system one of the largest in the world [1]. Every year a large part of these doctors leaves India for residency training and/or practice abroad whereas about 1,500 medical graduates each year enter residency training in the United States of America [2].

Lack of interaction between the teacher and the students and passive learning is involved in didactic theory teaching as well as rare organisation of tutorials have been mentioned in an article [3]. Abraham Flexner persuaded the medical establishment of his time that teaching the sciences, from basic to clinical, should be a critical component of the medical student curriculum, thus giving rise to the "preclinical curriculum" [4].

Objectives of pharmacological education include many goals like training one in selecting criteria of effective and safe drug use for patients, training in clinical skills required for practicing effective pharmacotherapy and improving prescribing efficiency [5].

Professional skill is yet another aspect of training a student which would enable him to perform his expected duties and these may include: Communication skills, Prescription writing skills, Critical appraisal skills, Community related skills etc [6].

Requirements of an undergraduate medical student, at the end of three semesters in pharmacology (II phase M.B.B.S), *should*: Be equipped with the requisite skills to prescribe drugs rationally. Practice cost-effective medicine. Be aware of when not to give medicine. Have a sound knowledge of pharmacokinetics and pharmacodynamics of those drugs which he/she is using. Collect information from authentic texts and journals and not from the literature provided by the detail men. Be a lifelong learner and practice self-directed learning for which he/she has developed critical appraisal skills. Possess good communication skills and be able to administer drugs by various routes. Prescribe to the children, the elderly and those with renal, hepatic and cardiac diseases [3].

A sound knowledge of patho-physiology of a disease and Clinical Pharmacology and Therapeutics (CPT) of a drug is required for safe and rational prescribing and it has been shown that CPT teaching to undergraduates is inadequate in countries like Nigeria [6]. An Integrated Life Sciences program was developed by the University of Pittsburgh School of Medicine where it has been stressed the importance of revising basic sciences when one starts interacting with clinical cases and it has also been stressed the necessity of further work which is needed to define in more detail the ways in which students benefit from ILS-like programs which help students to become better thinkers and better lifelong learners [4].

Hardly any integrated/interdisciplinary teaching takes place in teaching pharmacology in Indian medical colleges [3].

Integrated lectures as recommended by WHO should follow the earlier coverage by individual departments and Problem Based Learning (PBL) should be preferred to traditional learning [7]. In India although vertical and horizontal integration is advocated by the MCI regulations, discipline-based teaching remains the predominant mode of education [8].

A survey conducted regarding pharmacology teaching and learning revealed that many of the pharmacology teachers are aware of non traditional teaching and learning methods and believe that they are both appropriate to the discipline and effective in producing learning gain in the students [9].

Attitudes have a very strong influence on the behaviour of a person [10]. They form the link between knowledge and practice. The importance of students' attitude towards the training program in undergraduate medical education is being increasingly recognised.

As the literature survey indicates the scarcity of conductance of integrated teaching programmes and the strong need to incultate integrated teaching in the undergraduate medical curriculum, the present study was planned. Along with integrated teaching we have also evaluated and compared the tutorial and the existing theory class teaching.

Objectives of the study:

1. To introduce the concept of Integrated Teaching.
2. To evaluate three teaching methods viz., theory class, tutorial and integrated teaching.
3. To compare the three types of teaching methods and;
4. To know the attitude of students.

MATERIALS AND METHODS:

Study design: Experimental study. Sample size was 126 consisting of II-phase M.B.B.S students of 2011-12 batch.

Theory classes: These were engaged by different faculty members of the Department of pharmacology. The topics were covered for the first time in theory class. Theory classes were of one hour duration.

Tutorials: Similarly, tutorials were engaged by different faculty members of the Department of pharmacology. Tutorials were conducted on the topics which were earlier taught in the theory class. Topics of the tutorials were displayed well in advance (1 week prior) on the notice board for the reference of students. Interaction sessions were conducted in the tutorials for two hours.

Integrated teachings: The "topic" is covered for the first time. About ten students were chosen randomly and "subtopics" were assigned to them well in advance. Relevant clinical cases (like P.B.L) were also included in the sub topics for case oriented learning.

Each student reviewed his/her subtopic by going through different books in the library, consulting the clinical teacher or experts in that field, using e-learning etc. Pre final copy of the power point presentation was shown to the concerned teacher (each faculty was allotted equal number of presenting students) in the Department of pharmacology, who suggested corrections to be made in the power point before presenting in the integrated teaching.

On the day of integrated teaching (3 Hours duration) these chosen students presented their subtopics of a main topic in front of the full class consisting of 126 students of II M.B.B.S. After each subtopic there were interactions between the presenter and the students and the staff. Experts from different departments were invited and they also interacted and at the end they tried to full-fill the gaps in the teachings by addressing the students. Each presenting student was assessed by each faculty of the department as well as by the experts from different departments in a standard assessment(preparation in terms of depth, extent, slides; presentation in terms of order, clarity, confidence, use of audio visual aids, ability to respond questions etc) form .

Topics covered in integrated teachings were: Essential drug concept and principles of rational use of drugs, Drugs for cough and bronchial asthma, Anti-diabetic drugs, Antihypertensive drugs, General Anaesthetics and Local Anaesthetics, Psychopharmacology, Anti-tubercular drugs, Anti-malarial drugs, Anti-leprosy drugs, Drug therapy of peptic ulcer.

Example:

Main Topic: Antidiabetic Drugs

Sub topics: Roll No: 83 - Patho-physiology and types of Diabetes Mellitus.

Roll No: 4- Classification of Drugs.

Roll No: 113- Oral hypoglycaemic drugs- Sulfonylureas.

Roll No: 34- Oral hypoglycaemic drugs- Biguanides & Meglitinide analogues.

Roll No: 54- Oral hypoglycaemic drugs - Thiazolidinediones & alpha-glucosidase inhibitors.

Roll No: 93- Insulin.

Roll No: 24 – Treatment of Type-I D.M (along with clinical case).

Roll No: 123 – Treatment of Type-II D.M (along with clinical case).

Roll No: 45- Treatment of Diabetic coma (along with clinical case).

Roll No: 103- Management of D.M as a whole.

Roll No: 14- Non-pharmacological management of D.M.

Roll No: 73- WHO guidelines in management of D.M.

Pre and post tests were conducted- 10 each, for theory class, tutorial and integrated teaching. Each test comprised of 10 validated multiple choice questions (M.C.Q's) with single answer type.

Attitude tests: Student's attitude towards retention, recalling and reproducing was analysed by different questionnaires with five point grading scale. The questions were framed in accordance with Likert scale, so that each question can be answered in a graded scale viz., 5- Strongly agree, 4- Agree, 3- Neither agree or disagree, 2 - Disagree & 1 –Strongly disagree [11].

Voluntary consent of all the participants was obtained in a prescribed standard format. Ethical clearance was obtained from Institutional Ethics Committee for Human Subjects Research. For absent students during different classes, the average mark for that class was added. Data of all the tests were analysed by using parametric and nonparametric tests. $p<0.05$ was considered as significant.

RESULTS: Comparison of pre and post test scores of ten classes revealed that post test scores were significantly ($p<0.001$) higher when compared to pre test scores of theory classes and tutorials as well as integrated teachings respectively [**Table 1**].

Comparison of differences of pre and post test scores revealed that theory class teaching scores were significantly ($p<0.001$) higher when compared to integrated teaching scores which were in turn significantly ($p<0.001$) higher when compared to the scores of tutorials [**Table 2**].

The attitude tests showed that theory class teaching, tutorial, bedside clinical teaching and integrated teaching helped better in understanding of pharmacology subject in the descending order [significant ($p<0.001$) difference was noted between different teaching methods] [**Table 3**]. Similarly, retention of pharmacology subject was better by bedside clinical teaching, tutorial, theory class teaching and integrated teaching in the descending order [significant ($p<0.001$) difference was noted between different teaching methods] [**Table4**]. Theory class teaching, tutorial, bedside clinical teaching and integrated teaching methods were helpful to pass the examinations in the descending order [significant ($p<0.001$) difference was noted between different teaching methods] [**Table 5**].Clinical applications can be learnt better from bedside clinical teaching and tutorial followed by theory class teaching and by integrated teaching [**Table 6**]. Tutorial and bedside clinical teachings were helpful on long run followed by theory class teaching and by integrated teaching [**Table 7**].

Another attitude test revealed that chalk piece method of teaching helps (significantly) better in understanding, retention, recording (note down), recalling(reproducing) the pharmacology subject when compared to power point method of teaching [**Table 8**]. Chalk piece method of teaching also helps (significantly) better than power point teaching method in passing the examinations and in clinical applications.

TABLE 1: COMPARISON OF SCORES OF PRE AND POST TESTS OF VARIOUS TEACHING METHODS

Theory classes		Tutorials		Integrated teachings	
10 Classes		10 Classes		10 Classes	
Pre tests	**Post tests**	**Pre tests**	**Post tests**	**Pre tests**	**Post tests**
(n=126) Mean ± S.E.M					
33.97±0.6787	57.89±1.1010*	69.81±0.7750	80.14±0.7142*	53.56±0.7876	71.33±0.7893*
t=20.80, df= 125		t=12.16, df= 125		t=22.55, df= 125	

Paired 't' test, *$p<0.001$ when post test scores were compared to pre test

TABLE 2: COMPARISON OF DIFFERENCES OF PRE AND POST TEST SCORES OF VARIOUS TEACHING METHODS

Theory classes	Tutorials	Integrated teachings
10 Classes	10 Classes	10 Classes
	(n=126) Mean ± S.E.M	
23.92 ± 1.1500*	10.33 ± 0.8498*	17.77 ± 0.7881*

Anova followed by Bonferroni test. F= 2,375, 52.09,* $p<0.001$. All the three teaching methods differed from each other significantly

TABLE 3: ATTITUDE TEST REGARDING HELPFULNESS OF VARIOUS TEACHING METHODS TOWARDS UNDERSTANDING THE SUBJECT

(n=108)	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Theory class helps in understanding pharmacology subject.	27.77% (30)	37.03% (40)	26.85% (29)	8.33% (9)	0.00% (0)
Tutorial helps in understanding pharmacology subject.	17.59% (19)	38.89% (42)	35.19% (38)	6.48% (7)	1.85% (2)
Integrated teaching helps in understanding pharmacology subject.	18.52% (20)	24.07% (26)	23.15% (25)	21.30% (23)	12.96% (14)
Bedside clinical teaching helps in understanding pharmacology subject.	21.30% (23)	36.11% (39)	31.48% (34)	9.26% (10)	1.85% (2)

Chi square test, chi square value = 50.91, df=12,*$p<0.001$

TABLE 4: ATTITUDE TEST REGARDING HELPFULNESS OF VARIOUS TEACHING METHODS TOWARDS RETENTION OF THE SUBJECT.

(n=108)	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Theory class helps in retention of pharmacology subject.	6.48% (7)	34.26% (37)	36.11% (39)	19.44% (21)	3.70% (4)
Tutorial helps in retention of pharmacology subject.	8.33% (9)	36.11% (39)	41.67% (45)	12.96% (14)	0.93% (1)
Integrated teaching helps in retention of pharmacology subject.	9.26% (10)	31.48% (34)	22.22% (24)	25.93% (28)	11.11% (12)
Bedside clinical teaching helps in retention of pharmacology subject.	13.89% (15)	37.96% (41)	37.96% (41)	8.33% (9)	1.85% (2)

Chi square test, chi square value = 38.07, df= 12,*p<0.001

TABLE 5: ATTITUDE TEST REGARDING HELPFULNESS OF VARIOUS TEACHING METHODS TOWARDS PASSING THE EXAMINATIONS

(n=108)	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Theory classes are helpful to pass the examinations.	15.74% (17)	27.78% (30)	44.44% (48)	6.48% (7)	5.56% (6)
Tutorials are helpful to pass the examinations.	14.81% (16)	27.78% (30)	43.52% (47)	9.26% (10)	4.63% (5)
Integrated teachings are helpful to pass the examinations.	10.19% (11)	17.59% (19)	29.63% (32)	25% (27)	17.59% (19)
Bedside clinical teachings are helpful to pass the examinations.	15.74% (17)	25% (27)	34.26% (37)	18.52% (20)	6.48% (7)

Chi square test, chi square value = 38.91, df= 12,*p<0.001

TABLE 6: ATTITUDE TEST REGARDING CLINICAL APPLICATION OF VARIOUS TEACHING METHODS

(n=108)	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Clinical applications can be learnt from theory classes	11.11% (12)	29.63% (32)	35.19% (38)	17.59% (19)	6.48% (7)
Clinical applications can be learnt from Tutorials	12.96% (14)	33.33% (36)	26.85% (29)	22.22% (24)	4.63% (5)
Clinical applications can be learnt from Integrated teachings	9.26% (10)	25% (27)	25.93% (28)	26.85% (29)	12.96% (14)
Clinical applications can be learnt from Bedside clinical teachings	17.59% (19)	26.85% (29)	31.48% (34)	19.44% (21)	4.63% (5)

Chi square test, chi square value = 16.25, df= 12, Non significant.

TABLE 7: ATTITUDE TEST REGARDING LONG RUN HELPFULNESS OF VARIOUS TEACHING METHODS.

(n=108)	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Theory classes are helpful on long run	14.81% (16)	21.30% (23)	30.56% (33)	14.81% (16)	18.52% (20)
Tutorial classes are helpful on long run	16.67% (18)	26.85% (29)	26.85% (29)	17.59% (19)	12.04% (13)
Integrated teachings are helpful on long run	10.19% (11)	23.15% (25)	26.85% (29)	19.44% (21)	20.37% (22)
Bedside clinical teachings are helpful on long run	21.30% (23)	23.15% (25)	34.26% (37)	10.19% (11)	11.11% (12)

Chi square test, chi square value = 14.32, df= 12, Non significant.

TABLE 8: ATTITUDE TEST REGARDING COMPARISON OF CHALK PIECE AND POWER POINT TEACHING METHODS IN TERMS OF VARIOUS CRITERIA

This teaching method helps in	Chalk piece teaching (n = 86)					Power point teaching (n = 86)				
	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree	Strongly agree	Agree	Neither agree or disagree	Disagree	Strongly disagree
Understanding the subject***[1]	47.67% (41)	40.70% (35)	6.98% (6)	2.33% (2)	2.33% (2)	13.95% (12)	38.37% (33)	17.44% (15)	11.63% (10)	18.60% (16)
Retention of the subject***[2]	33.72% (29)	39.53% (34)	20.93% (18)	3.49% (3)	2.33% (2)	13.95% (12)	31.40% (27)	22.09% (19)	23.26% (20)	9.30% (8)
Recording (note down)**[3]	34.88% (30)	24.42% (21)	20.93% (18)	16.28% (14)	3.49% (3)	12.79% (11)	34.88% (30)	24.42% (21)	18.60% (16)	9.30% (8)
Recalling (reproducing) the subject***[4]	27.91% (24)	45.35% (39)	6.98% (6)	17.44% (15)	2.33% (2)	9.30% (8)	32.56% (28)	32.56% (28)	16.28% (14)	9.30% (8)
Passing the exams**[5]	32.56% (28)	29.07% (25)	19.77% (17)	6.98% (6)	11.63% (10)	13.95% (12)	29.07% (25)	20.93% (18)	22.09% (19)	13.95% (12)
Clinical application*[6]	26.74% (23)	33.72% (29)	23.26% (20)	11.63% (10)	4.65% (4)	9.30% (8)	39.53% (34)	24.42% (21)	15.12% (13)	11.63% (10)

Chi square test, chi square value = 36.01 [1], 24.04 [2], 13.03 [3], 27.68 [4], 13.37 [5] &10.64 [6], df=4, p<0.05*,p<0.01** and p<0.001***

DISCUSSION: The results of the present study indicate that all the three teaching methods viz., theory class teaching, tutorial and integrated teaching are significantly effective. When the differences between post and pre test were compared, theory class teaching was most effective, reason for this may be due to the teaching/explanations by the experts in the field. But usually theory class teaching is considered as didactic and passive learning and it involves lesser or no interactions with students.

Results indicated that integrated teaching was more effective after theory class teaching. The integrated teaching can be vertical or horizontal. Our experience in the present study indicates many advantages of integrated teaching like integration of information regarding drugs, expert's opinion from the different departments concerned with the topic can be obtained, recent information from clinical departments and clinical trials can be learnt. Integrated teaching helps the undergraduate students to develop practical/clinical approach to the individual condition while deciding the drugs.

One can be able to decide the therapy in special cases like pregnancy, lactation, paediatrics age group, elderly age group and conditions like liver and kidney impairment etc., the need for which has been stressed [12]. In medical education the importance and the need for medical practitioners to develop habits and skills of critical thinking has been stressed [13].

There will be active interactions with the fellow students, faculty members and the experts in the concerned topic from different departments which will expose all to the newer/current knowledge. Integrated teaching can be useful to satisfy most of the goals of pharmacological education regarding development of clinical skills mentioned by Jean Sice [5].

The presenting student's assessment will help to guide him to improve his lacunae's. While preparing for integrated teaching students will be exposed/accustom to collection of information from different sources like books/library, e-learning, journals and by interacting with experts in pre, para and clinical departments etc., preparation of power point, stage speaking and interactions(answering the queries).Importance of integrating e-learning in to medical education has also been stressed [14]. Integrated teaching is an active learning process which has an overall approach including the basics and recent advances.

Thus integrated teaching will train the students to self directed learning, interact with teachers of different pre, para and clinical departments (expert's opinion), review literature, know recent trends in therapeutic management of diseases, prepare power point, develop presentation skills on stage and prepare for interactions with peer. The need for transforming passive learning towards active learning has been stressed by many authors.

Tutorial was also a significantly effective teaching method and it involves active learning by the students. A student can clear his/her doubts by participating in the interaction session and he/she can compare his performance with that of other classmates. Teachers can also put an eye on individual student's progress and try to rectify the hindrances involved in learning.

In the present study we have tried to interpret the results of student's attitude tests. Results of the attitude tests showed that "understanding" of pharmacology subject was better by theory class teaching, which may be due to the fact that topics of theory class were taught and explained by the expert who is having many years of teaching experience whereas, tutorial involves active learning by the students. In bedside clinical teaching student learns the subject by actually analysing the case (patient).

Results of attitude tests regarding "retention" of the pharmacology subject suggest that students preferred bedside clinical teaching which may be due to practically (clinical) learning pharmacology as mentioned earlier. Tutorial is preferred second, which may be due to the fact that student revises and comes for the interaction session of a topic which has already been covered in the theory class teaching. Theory class teaching and integrated teaching were preferred later because of the coverage of the topic only once.

Similarly theory class teaching and tutorial are preferred for their "usefulness in passing the examination" because of the above said reasons. From experience, some faculty members stress on the sub-topics in a theory class which have chances of appearing as a question in the examinations.

As expected, bedside clinical teaching was preferred for learning "clinical applications" followed by tutorial, theory class and integrated teaching. Bedside clinical teaching is preferred for its "usefulness on long run" which may be due to the fact that most of the students are going to do general practice or do a postgraduate degree which requires clinical practice. As it facilitates consolidation of memory, tutorial is preferred next.

Overall integrated teaching is less preferred which may be due to the reason that the topic is taught by fellow students and not by an expert teacher. Due to their busy schedule during second phase where in students have to attend theory classes, practical classes and clinical postings of other disciplines they may not like to invest more time in preparing power point presentations in integrated teachings. There may be some anxiety associated with stage speaking in front of the class.

Surprisingly another attitude test revealed that students preferred chalk piece teaching over power point method of teaching in different aspects of learning the subject. This may be due to the reason that chalk piece teaching involves explanations and give sufficient time intermittently to note the important points written on the black board which helps to grasp the subject. Even though the power point method of teaching is new and much popular method, it may involve some drawbacks like fast reading of the topic by the teacher by pressing the slides and there will be lesser time for noting the important points.

CONCLUSIONS: Results of the present study indicate that introduction of Integrated teaching method was successful. Results indicate that all the three teaching methods viz., theory class teaching, integrated teaching and tutorial are significantly effective. Student's attitude tests revealed merits and demerits of theory class, tutorial, integrated teaching and bedside clinical teaching. As there is a need for an educator to shift from a teacher who is a distributor of content towards becoming facilitator of learning and assessor of competency, findings of the present study will help in further educational research. Present findings of the study can be applied to other subjects with some modifications as needed by the subject.

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