

## RESEARCH ARTICLE

### Impact of horizontal and vertical integration: Learning and perception in first-year medical students

Puja Dulloo, Neeraj Vedi, Achleshwar Gandotra

Department of Physiology, Smt. B K Shah Medical Institute and Research Centre, Sumandeep Vidyapeeth, Piparia Vadodara, Gujarat, India

Correspondence to: Puja Dulloo, E-mail: pujadullo@gmail.com

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#### ABSTRACT

**Background:** Medical field and its curriculum is dynamic in nature which keeps on adding huge data each year, thus overburdening the students with content information. Most of the colleges in India teach subject in isolation with little or no attempt to integrate in basic science. This leads to confusion in students mind due to different opinion leading to improper grasping of these basic foundation subjects. Integration allows organization of teaching matter to unify subjects frequently taught in separate academic departments. **Aims and Objectives:** The aim of this study is to finding the perception and learning by integrated teaching approach for first-year medical students. **Materials and Methods:** A total of 150 students enrolled for the academic year 2016-2017 in medical program of Sumandeep Vidyapeeth were considered. Non-randomized and purposive study was done by providing survey questionnaire. Two focus group discussions (FGD) were conducted with 15 students in each group after completion of session. Pre-post test was conducted to assess learning outcome of students by feedback methodology. Data were collected, analyzed statistically using paired *t*-test and correlation analysis for gender variability for perception. **Results:** Pre-post test showed statistical significance ( $P < 0.001$ ) for learning after each integrated session. Survey questionnaire and FGD results implied that students' learning process was enhanced by this teaching approach. Although statistical significance for gender variability as per perception was only for two questions among 27. About 71-79% of students accepted that sessions allowed them for better understanding and relate clinical implication of the course. **Conclusion:** In-depth understanding of the application of course content was achieved other than that it encouraged student's intellectual curiosity. They wanted to have these sessions frequently and for various other topics with other departments.


**KEY WORDS:** Horizontal and Vertical Integration; Learning; Perception

#### INTRODUCTION

Integrated teaching in medical schools is widely adopted, however in basic science disciplines, dissatisfaction has been observed, with no clinical application or interdisciplinary

inquiry.<sup>[1,2]</sup> Central theme of the Medical Council of India (MCI) since long has been integration at pre-clinical level. Moreover, vision 2015 of MCI where competency-based education system has to be incorporated, lays great focus on integrated approach from the first-year level of Bachelor of Medicine and Bachelor of Surgery (MBBS). Although little is known about how different stakeholders perceive this curriculum change.<sup>[3]</sup>

Medical education literature has various stories of curriculum changes from the past till date.<sup>[4-9]</sup> It has been reported that students trained within an integrated curriculum made more accurate diagnosis compared to students who had

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traditional/conventional curriculum.<sup>[10]</sup> Vertical integration between basic science and clinical medicine in problem-based learning curriculum stimulated better understanding of applied principles than did conventional curriculum.<sup>[11]</sup> Harden<sup>[12]</sup> argues that integrated curriculum can be viewed as a ladder, with discipline-based teaching at the bottom and full integration (“trans-disciplinary teaching”) at the top level.

Brauer and Ferguson<sup>[13]</sup> have reviewed various theories, models, and examples of integrated curricula suggested that the spiral curriculum as an ideal model. It identifies and offers solutions to three frequent shortcomings of integration, thus avoiding the tendency to diminish the importance of the basic sciences. It is important to decide scope and level of integration before planning. Moreover, it is feasible to start with a small module and then extend it into other areas in the curriculum.<sup>[14]</sup>

It is understood that integrated thinking is effective approach to individualize the learning<sup>[15]</sup> other than motivate and satisfy freshly joined medical students. This will also provide them a linkage within the medical course being taught at different levels and allow them to have deep learning with ability to self-reflect on their learning. This integrated way of learning is abbreviated without repetition in different subjects giving a composite picture with simultaneous clinical demonstration.<sup>[16]</sup> Even MCI has recognized need to incorporate it for undergraduate students with specific objectives, thus provide knowledge in a holistic way.<sup>[17]</sup>

With all the above aspects in mind, the aim of this study was to explore the perception of students toward integrated teaching during the first year of medical school and assessing improvement in their learning with horizontally as well as vertically integrated teaching. Authors planned their study based on the scope and level of integration. Looking into the feasibility, they initiated it for some of the topics of the cardiovascular system (CVS) and central nervous system (CNS) in physiology and some practical topics in physiology such as history taking and cardiopulmonary resuscitation (CPR).

### Aim

The aim of this study was to finding the perception and learning by integrated teaching approach for first-year medical students.

### Objectives

1. To provide appropriate integrated sessions in theory and practical sessions,
2. To determine the perception outcome of integrated teaching among students and assess its gender variation,
3. To assess the learning outcome after the integrated teaching session.

## MATERIALS AND METHODS

This study started after taking prior approval from the Ethical Committee of Sumandeep Vidyapeeth University. 150 first year MBBS students enrolling for 2016-17 batch participated in this study while repeater students were excluded from this study. All the sessions were conducted in lecture hall and practical laboratories of the Department of Physiology in Smt. B.K. Shah Medical Institute and Research Center, Sumandeep Vidyapeeth University, Piparia, Vadodara.

This is an observational, cross-sectional, and questionnaire-based study.

This study was conducted for 3 theory topics (two of CVS and one from CNS) and 2 practical sessions related to history taking and CPR integrated horizontally with anatomy department and vertically with medicine and ICU departments. Pre-post test was conducted before and after the integrated session to assess the learning outcome of students. Data related to perception of students for corrective implementation and its importance were collected using a questionnaire after validating it by subject experts using Likert scale.<sup>[18]</sup> Focus group discussion (FGD) was also conducted to reconfirm our findings after completion of the study. Statistical analysis of the data was done using SPSS version 23 software. Data analysis allowed us to prepare evaluation matrix up to the level 2, i.e., we could find reaction as well as learning of the students.

## RESULTS

### Learning Outcome

Figure 1 represents descriptive statistics for learning the outcome of students for integrated teaching showing increased mean value for post-test for each integrated session.

### Perception Outcome

Table 1 shows frequency distribution for 27 questions asked to assess the perception for integrated teaching sessions vertically and horizontally. It shows Cronbach’s alpha reliability value of >0.663.

Agreeing with the question 1, 2, 3, and so on till 20 implies that the students felt that there is an improvement in the process of learning during integrated teaching and prefer to have integration for every subjects.

Table 2 shows group statistics as per gender for the perception of students for integrated teaching sessions and shows statistical significance of <0.001 for the question “Module was well organized” and for the question “I think more time should be devoted for conduct of these sessions” of <0.05

other than these none of the perception question showed statistical significance among the gender.

Table 3 shows FGD done among two groups of students each having 15 participants with 3 keys question and their comments.

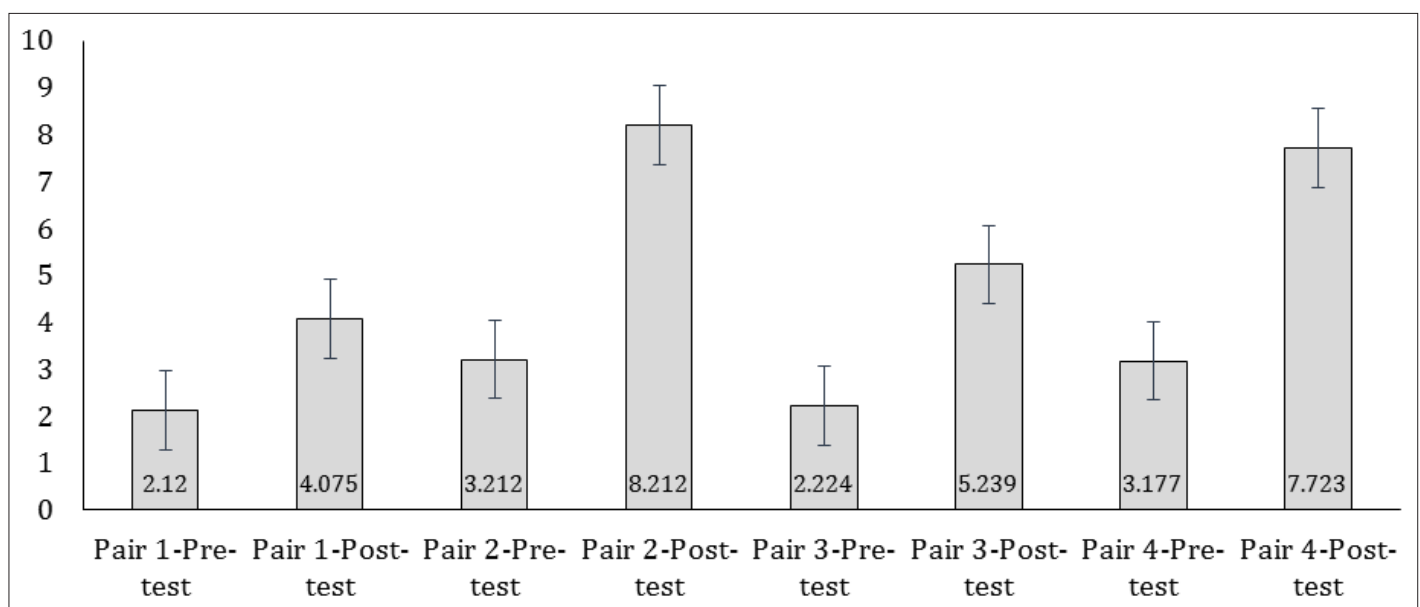
## DISCUSSION

The present study shows statistical significance for learning outcome by integrated teaching, horizontal as well as vertical with a significance of 2 tailed  $<0.0001$  (Figure 1 and Table 4). Perception of students for integrated teaching (Table 1 and 3) showed agreement by 71% of students for the technique and supported that approach gave them better understanding of the topic, whereas 79% accepted that session enabled them to relate it with the clinical implication. While 75% of students accepted that integrated sessions are more effective than didactic lectures. 69% of students accepted that the integrated teaching technique encouraged their intellectual curiosity. While 93% of students responded that horizontal integrated teaching is more interesting than traditional teaching and less repetitive. 60% of students in the present study showed enhanced interaction between instructor and students during the sessions. 80% of students agreed that these types of sessions should be used for majority of practical classes, whereas only 55.5% accepted to have it for majority of theory classes. 57.5% of students agreed that the module was well organized. 58% of students disagreed that the sessions were time-consuming, whereas 70% disagreed that sessions confused them at the theoretical level.

Gender variability in the present study (Table 2) showed statistical significance for two questions, "Module was

well organized," "I think more time should be devoted for conduct of these sessions." Although for other 25 questions, no gender difference was observed. FGD from two group highlighted that vertical integration approach was more liked and students felt that they could understand better and remember more. They even suggested to have complete horizontal integration for the first year MBBS subjects and for as many topics as possible. Even they recommended different ways of assessment after every integrated teaching session, specifically having role play in practical sessions.

Kate *et al.*<sup>[19]</sup> showed that the results for learning outcome for integrated learning were statistically significant as that of ours. While for the perception in Table 2, our results are in concordance with the study by other researches.<sup>[20-23]</sup> Kate *et al.*<sup>[19]</sup> also used integrated teaching in second-year medical students to have better clinicopathological correlation along with improvement in cognitive and psychomotor domain. Faculty and students both had positive attitude toward this method. Perception of students for having encouraged intellectual curiosity is in concurrence with our study as well as the study by Sharma *et al.*<sup>[24]</sup> whose results showed that 81% of students responded that they were able to correlate clinical picture of the disease after integrated teaching sessions and 85% of students were agreed that there was a good correlation of all three pre-clinical subjects. Ali *et al.*<sup>[25]</sup> concluded in their study that the experience of integrating clinical teaching with basic sciences not only improved students' clinical experience reflected by evaluation but also rewarding in improving the results of various modules related to anatomy and physiology. Positive interaction which helped students to correlate whole aspect was provided in the present study as well as by studies done by researchers such as Dandannavar at Karnataka,<sup>[26]</sup> Nikam and Chopade at Mumbai,<sup>[20]</sup> Kadam and Sane at



**Figure 1:** Descriptive statistics for learning outcome of students for integrated teaching

**Table 1:** Frequency distribution for survey questionnaire for perception for integrated teaching sessions by medical students of 2016-2017 batch

Questions	Frequency in percentage for survey questionnaire about integrated teaching sessions					Mean±SD
	Strongly disagree	Disagree	Indifferent	Agree	Strongly agree	
Technique allowed better understanding of the coordinated action of several system	1.4	3.4	14.4	62.3	18.5	3.93±0.77
Session increased my interest in the topic taught	0.7	6.8	17.8	52.7	21.9	3.88±0.85
Session enabled me to relate with clinical implication	4.1	5.5	11.0	53.4	26.0	3.92±0.98
Session enhanced interaction between instructor and student	3.4	11.0	26.0	47.3	12.3	3.54±0.96
The learning acquired through these sessions allowed me to appreciate human body function	3.4	4.8	23.3	50.0	18.5	3.75±0.93
Facilitated collaborative learning among students	2.7	14.4	37.0	37.0	8.9	3.35±0.93
Session is advantageous for clinical practical sessions compared to theory	0.00	6.8	8.2	46.6	38.4	4.16±0.85
Should be used for major theory classes	2.1	15.1	27.4	32.2	23.3	3.6±1.07
Should be used for major practical classes	2.1	6.2	11.6	45.9	34.2	4.04±0.95
Integration should be done using a clinical case	1.4	3.4	9.6	45.2	40.4	4.2±0.85
The teacher/teachers provided guidance for self-learning	2.7	11.0	31.5	46.6	8.2	3.47±0.9
The teacher/teachers paid enough personal attention to the students	6.8	16.4	21.9	42.5	12.3	3.37±1.11
As a student, I was comfortable with this teaching technique	2.7	8.2	16.4	58.2	14.4	3.73±0.9
I expect to score better in this topic as a result of this teaching	0.0	6.8	23.3	56.2	13.7	3.77±0.77
The teaching technique encouraged my intellectual curiosity	0.0	8.2	22.6	46.6	22.6	3.84±0.87
Entire syllabi for three departments should be integrated	5.5	17.8	17.8	38.4	20.5	3.51±1.16
Module was well organized	8.2	8.2	26.0	52.7	4.8	3.38±1.0
I think more time should be devoted for conduct of these sessions	4.8	8.2	24.0	47.3	15.8	3.61±1.0
Integrated teaching is more effective than didactic lecture	2.7	6.8	13.0	50.0	27.4	3.92±0.96
Session allowed me to integrate topics across the disciplines	3.4	6.8	23.3	53.4	13.0	3.66±0.91
Session was time-consuming	19.2	38.4	17.8	17.1	6.8	2.54±1.19
The session confused me at theoretical level	28.8	49.3	14.4	6.8	0.7	2.01±0.88
It was difficult to focus throughout the session	21.2	51.4	11.6	11.0	4.1	2.38±1.94
It was not an interactive session	22.6	52.1	13.0	8.9	3.4	2.18±1.0
Topic was not given beforehand	22.6	42.5	15.8	17.1	2.1	2.34±1.1
Huge content was covered in a short time	8.9	31.5	19.2	32.2	8.2	2.99±1.15
Some of the content was irrelevant and unnecessary	22.6	46.6	15.1	9.6	5.5	2.12±0.88

SD: Standard deviation

Maharashtra,<sup>[27]</sup> Soudarssanane and Sahai at Jipmer,<sup>[28]</sup> Kumari et al. at Bengaluru,<sup>[29]</sup> Mahajan et al. at Ahmedabad<sup>[30]</sup> and Rehman et al. at Pakistan.<sup>[31]</sup> Sherer et al.<sup>[32]</sup> and Deepti and Shashikala at Karnataka<sup>[33]</sup> while Joglekar et al. at Mumbai<sup>[34]</sup> concluded that students following integrated curriculum were satisfied with their course and made learning easy and fruitful by correlating theoretical virtual physiological application more realistic by linking it with clinical approach. As far as time duration for this teaching approach, our results are concord with that of Lohitashwa<sup>[21]</sup> study who showed that their students suggested that integrated should be conducted once in a fortnight. Authors could not find any gender association for integrated teaching.

The present study illustrates students' perceptions about integrated teaching and adds to the emerging literature focused on improving student learning and experience. The survey and FGD presented students with an opportunity to reflect on the significance of feedback in their learning. The findings highlighted the importance of developing a much in-depth integration program horizontally and vertically so they will be able to understand the concepts in better manner, moreover, they will be able to integrate topics within their mind although they are taught separately under different subject heads. Way the students perceive the learning context and the way they approach learning affects their learning outcome is the reason to know the students' approach to

**Table 2:** Description statistics and independent Student's paired *t*-test for gender variability for perception related to integrated teaching

Questions	Male	Female	Levene's test for equality of variances as per gender	
	Mean±SD	Mean±SD	F	Significant
Technique allowed better understanding of the coordinated action of several systems	3.9±0.8	3.96±0.74	0.917	0.340
Session increased my interest in the topic taught	3.74±0.85	4.01±0.84	1.595	0.209
Session enabled me to relate with clinical implication	3.99±0.91	3.86±1.04	1.736	0.190
Session enhanced interaction between instructor and student	3.71±0.89	3.38±1.00	2.292	0.132
The learning acquired through these sessions allowed me to appreciate human body function	3.71±0.84	3.79±1.01	2.453	0.120
Facilitated collaborative learning among students	3.34±0.9	3.36±0.96	0.518	0.473
Session is advantageous for clinical practical sessions compared to theory	4.13±0.88	4.2±0.82	0.022	0.881
Should be used for major theory classes	3.37±1.1	3.8±1.05	0.096	0.758
Should be used for major practical classes	3.9±0.98	4.17±0.9	0.493	0.484
Integration should be done using a clinical case	4.07±0.86	4.32±0.84	0.786	0.377
The teacher/teachers provided guidance for self-learning	3.49±0.88	3.45±0.92	0.153	0.696
Teacher/teachers paid enough personal attention to the students	3.4±1.1	3.34±1.13	0.046	0.830
As a student, I was comfortable with this teaching technique	3.61±0.98	3.84±0.82	3.151	0.078
I expect to score better in this topic as a result of this teaching	3.79±0.87	3.75±0.68	1.872	0.173
The teaching technique encouraged my intellectual curiosity	3.74±0.79	3.92±0.94	0.025	0.876
Entire syllabi for three departments should be integrated	3.31±1.16	3.68±1.15	0.538	0.465
Module was well organized	3.17±1.14	3.57±0.81	7.007	0.009*
I think more time should be devoted for conduct of these sessions	3.41±1.08	3.79±0.9	5.138	0.025*
Integrated teaching is more effective than didactic lecture	3.79±1.03	4.05±0.88	2.440	0.121
Session allowed me to integrate topics across the disciplines	3.56±0.88	3.75±0.94	0.035	0.852
Session was time-consuming	2.54±1.19	2.53±1.19	0.002	0.967
The session confused me at theoretical level	1.96±0.89	2.07±0.87	0.581	0.447
It was difficult to focus throughout the session	2.24±0.98	2.51±2.52	2.531	0.114
It was not an interactive session	2.16±1.07	2.21±0.93	0.258	0.612
Topic was not given beforehand	2.20±0.99	2.46±1.14	3.250	0.074
Huge content was covered in a short time	2.93±1.13	3.05±1.17	0.161	0.689
Some of the content was irrelevant and unnecessary	2.20±0.88		0.151	0.085

SD: Standard deviation

**Table 3:** Three questions for FGD from 2016-17 batch of medical students

How beneficial was integrated teaching to you?	How can it be improved as per your viewpoint?
<ul style="list-style-type: none"> <li>• Better understanding</li> <li>• Liked the linkage of subjects</li> <li>• More integration for clinical session should be there</li> <li>• It develops better relation with faculties</li> <li>• Vertical integration explained us what we came to know how</li> <li>• Physiology is applicable in the near future</li> <li>• We could remember more</li> <li>• Better visualization</li> </ul>	<ul style="list-style-type: none"> <li>• More horizontal integration, including biochemistry subject too</li> <li>• Patient should be introduced during integrated session</li> <li>• Basic foundation should be laid then integration should be carried out</li> <li>• More topics should be used for integrated approach</li> <li>• Simulation-based sessions should be introduced</li> <li>• Time break should be more</li> </ul>
Anything specific?	
• Role play or other methods for assessment after every integrated teaching will make it more attractive	

FGD: Focus group discussions

teaching and learning methodology. Physiology course has huge probability of horizontal and vertical integration for vast number of topics but time factor was one of the biggest

limitations to expand our study for various other topics which has been pointed out by the students during FGD as scope for improvement.

**Table 4: Paired *t*-test for the learning outcome for integrated teaching sessions**

Integrated teaching session	Mean±SD	SEM	<i>t</i>	df	Significant (two-tailed)
Horizontal teaching Pre-test - post-test: 1	-1.96±1.07	0.093	-21.168	132	0.000*
Vertical teaching Pre-test - post-test: 2	-5.0±2.10	0.183	-27.396	131	0.000*
Horizontal teaching Pre-test - post-test: 3	-3.01±2.21	0.190	-15.836	133	0.000*
Vertical teaching Pre-test - post-test: 4	-4.55±2.21	0.194	-23.414	129	0.000*

\*Paired sample *t*-test showing significant difference (2 tailed <0.0001) for pre-post tests for learning by horizontal as well as vertical integration teaching. SD: Standard deviation, SEM: Standard error of mean

## CONCLUSION

In-depth understanding of the application of course content was achieved other than that it encouraged students' intellectual curiosity. They wanted to have these sessions frequently and for various other topics with other departments.

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