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# Horizontal Integrated Teaching with Case-Based Learning for First-Year Medical Students – A Pilot Study

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***Abstract :*** *This complete enumeration, comparative, before-and-after study (without controls) was conducted to determine the differences in cognitive domain scores of first-year medical students after traditional didactic lectures (by a pre-test) and that after horizontal integrated teaching with case-based learning (by a post-test). The pre-test was conducted after traditional didactic lectures, while an identical post-test was conducted after horizontal integrated teaching and case-based learning. The outcome studied was the difference in cognitive domain scores after traditional didactic lectures (by a pre-test) and horizontal integrated teaching with case-based learning (by a post-test). 59 students (31 females and 28 males) participated. The overall difference in mean correct responses between the pre- and post-test was statistically significant ($p<0.0001$), while the gender difference between the mean correct responses was statistically significant only for specific questions.*

***Keywords:*** *Integrated teaching, Case-based learning, First-year medical students*

## I. Introduction

Integrated teaching (IT) entails blending of teaching material to inter-relate different aspects of the same topic, which is customarily taught by separate academic departments. [1] Horizontal integration implies fusion of teaching in two or more disciplines taught concomitant in the same phase of the curriculum, while vertical integration is that between disciplines taught in the different phases of curriculum. [2] In order to provide medical students with holistic learning perspectives, the Medical Council of India has recommended IT between conventional subjects using a setting of clinical relevance to achieve both horizontal and vertical integration in different phases of the Bachelor of Medicine, Bachelor of Surgery (MBBS) course. [3] The “must know” component of information should be taught in an integrated manner. [4] The topics for IT are usually selected on the basis of interdisciplinary nature, preventability, and conditions that portray basic science concepts. [5] IT disseminates information from various disciplines and saves time and efforts of teachers. [6]

In case-based learning (CBL), actual or hypothetical case scenarios are created to generate interest in a specific topic. [7] Students discuss the case scenario in small groups and utilize the knowledge acquired from previously taught curricular content. This results in self-directed learning and application of their knowledge to the case scenario. The teacher acts as a facilitator in the learning process rather than as a provider of knowledge. Case scenarios that extend over multiple topics enable the students to generate inter-concept linkages that boost retention of knowledge [8] and development of a holistic perspective. [9] CBL enhances reasoning skills and grasp of basic sciences, since learning is placed within the framework of a practical problem. [10] CBL has been shown to impart early clinical exposure, improve students’ scores, enhance communication skills, stimulate the students towards self-directed learning, help students to link clinical conditions to basic sciences and cultivate clinical reasoning skills. [11] Clinical reasoning is a method of determining a range of facets of health and disease of the patients [12] and for promoting clinical reasoning among the students, the teachers need to know the basic aspects of the clinical reasoning process and focus the instructions suitably. [13]

## II. Objective

The objective of this study was to ascertain the differences in cognitive domain scores of first-year MBBS students after traditional didactic lectures (by a pre-test) and that after horizontal integrated teaching with case-based learning (by a post-test).

## III. Materials And Methods

**3.1. Study area:** This complete enumeration, comparative, before-and-after study (without controls) was conducted at Rajiv Gandhi Medical College, Kalwa, and Thane, located about 30 kms from Mumbai city, Maharashtra state, India.

**3.2. Inclusion criteria:** All first-year MBBS students, aged 18 years and above, of either sex, who gave written informed consent to participate were included in the study.
**3.3. Exclusion criteria:** Those students who did not give written informed consent or those who were absent during the educational interventions or pre-test or post-test were excluded.
**3.4. Procedure:** After obtaining permissions from the Institutional Ethics Committee and institutional authorities, the purpose of the study was explained to first-year MBBS students and written informed consent was obtained from those willing to participate in the study. Traditional didactic lectures (TDLs) were conducted by teachers from departments of Physiology (SB) and Anatomy (RG) on the topic of pancreas, as per syllabus for the first-year MBBS course. The pre-test, conducted after TDLs, comprised ten questions (one mark per question; total ten marks). After the pre-test, integrated teaching (IT) on pancreas was conducted by teachers from departments of Physiology (SB), Anatomy (RG) and Community Medicine (AM and SK). For case-based learning (CBL), the participating students were randomly assigned by lottery system to two sub-groups comprising 30 and 29 students to facilitate small-group discussion. Each sub-group was identically exposed to case-based learning modules using case scenarios pertaining to pancreatic dysfunction and related diseases. The same faculty jointly guided the discussion and encouraged participation of all students in each sub-group. The post-test was conducted after IT and CBL, using a questionnaire that was identical to that of the pre-test. The scores from students in the two sub-groups were combined for analyzing results of the pre- and post-tests. The outcome studied was the difference in cognitive domain scores after attending TDLs (by a pre-test) and IT with CBL (by a post-test).
**3.5. Statistical analysis:** The data were statistically analyzed using EpiInfo Version 7.0 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA). Data were presented as percentages, mean and standard deviation (SD). Confidence interval (CI) was stated as: [Mean-(1.96)*Standard Error)] - [Mean+(1.96)*Standard Error)]. Karl Pearson's Chi-square test with Mantel-Haenszel correction (where required) and the standard error of difference between two means were calculated. Statistical significance was determined at $p<0.05$.

## IV. Results

**4.1. Cognitive domain scores:** A total of 59 students (females: n=31; 52.54% and males: n=28; 47.46%) participated in the study. The overall mean correct responses (out of 10) increased from 5.68 ± 1.81 (95% CI: 5.22-6.15) in the pre-test to 7.35 ± 2.19 (95% CI: 6.68-7.79) in the post-test, exhibiting high statistically significant (Z=4.51; $p<0.0001$) difference. Question-wise statistically significant differences between the correct responses in the pre- and post-test (Table 1) were observed for question No. 2 (p=0.005), question No. 3 (p=0.00002), question No. 5 (p=0.0009), question No. 6 (p=0.00003), and question No. 8 (p=0.29).

**Table 1:** Correct responses in pre- and post-tests

| Q. No. | Pre-test (n=59) | Post-test (n=59) | Chi square value # | p value | Odds Ratio |
|---|---|---|---|---|---|
| 1 | 48 (81.36) | 51 (86.44) | 0.565 | 0.452 | 0.685 |
| 2 | 27 (45.76) | 42 (71.19) | 7.852 | 0.005 * | 0.342 |
| 3 | 18 (30.51) | 41 (69.49) | 17.93 | 0.00002 * | 0.193 |
| 4 | 41 (69.49) | 44 (74.58) | 0.379 | 0.538 | 1.288 |
| 5 | 23 (38.98) | 41 (69.49) | 11.06 | 0.0009 * | 0.281 |
| 6 | 25 (42.37) | 47 (79.66) | 17.24 | 0.00003 * | 0.188 |
| 7 | 48 (81.36) | 50 (84.75) | 0.241 | 0.624 | 0.786 |
| 8 | 35 (59.32) | 46 (77.97) | 4.764 | 0.029 * | 0.412 |
| 9 | 48 (81.36) | 50 (84.75) | 0.241 | 0.624 | 0.786 |
| 10 | 45 (76.27) | 51 (86.44) | 2.012 | 0.156 | 0.504 |

# Karl Pearson's Chi square test with Mantel-Haenszel correction, where required
Figures in parentheses indicate percentages; * statistically significant

**4.2. Gender differences:** In the pre-test, the minimum, first quartile, median, third quartile and maximum scores (out of 10) were identical for female and male participants. (Fig. 1) But in the post-test, female students obtained a higher minimum score (6) as compared to their male counterparts. The minimum score obtained by female students increased from 4 to 6 while that obtained by males increased marginally from 4 to 5. The median post-test score for females has merged with the third quartile, implying that 25% of the female students scored more than 8 (out of a maximum of 10). The first quartile (post-test) for both females and males was 7, indicating that 75% of students of either sex obtained a score of 7 or more (out of a maximum of 10). The post-test scores for males exhibited a greater variation as compared to that for females. (Fig. 1)

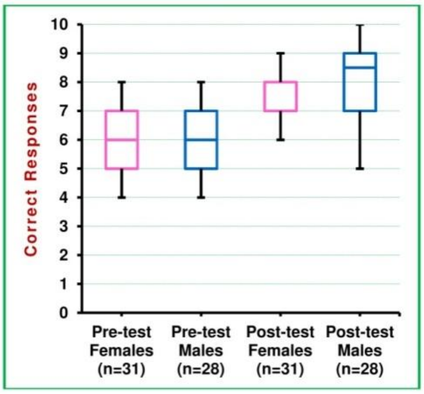


**Fig.1:** Box plot of gender differences in correct responses in pre- and post-tests

**4.3. Gender differences in the pre-test scores:** In the pre-test (Table 2), the gender differences between the mean correct responses were marginal and the females students obtained a significantly higher mean score in question No. 4 (p=0.0434). There was no gender difference in mean correct responses for question No.5.

**Table 2:** Gender differences in mean correct responses in the pre-test

| Q. No. | Females (n=31) | | Males (n=28) | | Z value # | p value |
|---|---|---|---|---|---|---|
| | Mean ± SD | CI | Mean ± SD | CI | | |
| 1 | 0.77 ± 0.43 | 0.62 - 0.92 | 0.86 ± 0.36 | 0.73 - 0.99 | 0.874 | 0.3788 |
| 2 | 0.42 ± 0.50 | 0.24 - 0.60 | 0.50 ± 0.51 | 0.31 - 0.69 | 0.607 | 0.5418 |
| 3 | 0.26 ± 0.44 | 0.11 - 0.41 | 0.36 ± 0.49 | 0.18 - 0.54 | 0.821 | 0.4122 |
| 4 | 0.81 ± 0.40 | 0.67 - 0.95 | 0.57 ± 0.50 | 0.38 - 0.76 | 2.022 | 0.0434 * |
| 5 | 0.39 ± 0.50 | 0.21 - 0.57 | 0.39 ± 0.50 | 0.20 - 0.58 | 0 | 1 |
| 6 | 0.35 ± 0.49 | 0.18 - 0.52 | 0.50 ± 0.51 | 0.31 - 0.69 | 1.149 | 0.2502 |
| 7 | 0.84 ± 0.37 | 0.71 - 0.97 | 0.79 ± 0.42 | 0.63 - 0.95 | 0.483 | 0.6312 |
| 8 | 0.61 ± 0.50 | 0.43 - 0.79 | 0.57 ± 0.50 | 0.38 - 0.76 | 0.306 | 0.7566 |
| 9 | 0.84 ± 0.37 | 0.71 - 0.97 | 0.79 ± 0.42 | 0.63 - 0.95 | 0.483 | 0.6312 |
| 10 | 0.77 ± 0.43 | 0.62 - 0.92 | 0.75 ± 0.44 | 0.59 - 0.91 | 0.176 | 0.8572 |

SD = Standard deviation; CI = Confidence interval; # Standard Error of difference between two means
* Statistically significant

**4.4. Gender differences in the post-test scores:** In the post-test (Table 3), gender differences between the mean correct responses were marginal and the male students obtained a significantly higher mean score only in question No. 3 (p=0.0384).

**Table 3**: Gender differences in mean correct responses in the post-test

| Q. No. | Females (n=31) | | Males (n=28) | | Z value # | p value |
|---|---|---|---|---|---|---|
| | Mean ± SD | CI | Mean ± SD | CI | | |
| 1 | 0.87 ± 0.34 | 0.75 - 0.99 | 0.86 ± 0.36 | 0.73 - 0.99 | 0.109 | 0.9124 |
| 2 | 0.65 ± 0.49 | 0.48 - 0.82 | 0.79 ± 0.42 | 0.63 - 0.95 | 1.181 | 0.238 |
| 3 | 0.58 ± 0.50 | 0.40 - 0.76 | 0.82 ± 0.39 | 0.68 - 0.96 | 2.066 | 0.0384 * |
| 4 | 0.71 ± 0.46 | 0.55 - 0.87 | 0.79 ± 0.42 | 0.63 - 0.95 | 0.698 | 0.484 |
| 5 | 0.65 ± 0.49 | 0.48 - 0.82 | 0.75 ± 0.44 | 0.59 - 0.91 | 0.826 | 0.4066 |
| 6 | 0.81 ± 0.40 | 0.67 - 0.95 | 0.79 ± 0.42 | 0.63 - 0.95 | 0.187 | 0.8494 |
| 7 | 0.84 ± 0.37 | 0.71 - 0.97 | 0.86 ± 0.36 | 0.73 - 0.99 | 0.210 | 0.8336 |
| 8 | 0.81 ± 0.40 | 0.67 - 0.95 | 0.75 ± 0.44 | 0.59 - 0.91 | 0.546 | 0.5824 |
| 9 | 0.87 ± 0.34 | 0.75 - 0.99 | 0.82 ± 0.39 | 0.68 - 0.96 | 0.522 | 0.603 |
| 10 | 0.87 ± 0.34 | 0.75 - 0.99 | 0.86 ± 0.36 | 0.73 - 0.99 | 0.109 | 0.9124 |

SD = Standard deviation; CI = Confidence interval; # Standard Error of difference between two means
* Statistically significant

## V. Discussion

Currently, medical education in India is weighed down by focus on traditional didactic lectures, inadequate integration of course material and unsatisfactory coordination between the departments teaching basic and clinical sciences. Repetition of the same topics by teachers of various departments results in wastage of time and efforts. The challenges of teaching physiology in an integrated curriculum have been reported [14-

18] and these include defining the core curriculum, sequencing content, faculty interest and expertise, and interdisciplinary integration.

The present study revealed that the mean correct responses of students after IT and CBL (post-test) were significantly higher ($p<0.0001$) than that obtained after TDLs (pre-test). Similar results have also reported by other studies. [19-25]

The gender difference between the mean correct responses was statistically significant only for question No. 4 and No. 3 in the pre- and post-tests, respectively. Several studies [26-31] have revealed gender differences in learning styles. Teachers who are aware of the multiplicity of learning styles can enhance student motivation and performance by creating suitable learning approaches to suit the learning style preferences of students. [32]

**5.1. Limitations:** Since this pilot study was conducted on only one batch of 59 first-year medical students, generalization of the findings would be encumbered. As a consequence of time constraints of the first year MBBS course, the participants could not be exposed to real-life patients. A larger study on integrated teaching with suitable cases would be necessary in order to generalize the results.

## VI. Conclusion

The statistically significant differences between the cognitive domain scores in the pre- and post-tests indicate that combination of integrated teaching with case-based learning increases cognitive domain scores. In spite of time constraints in the teaching schedule for first-year medical students, it is possible to conduct integrated teaching with case-based learning and provide early clinical exposure using case scenarios.

## References


[1] S. Joglekar, P. S. Bhuiyan, and S. Kishore, Integrated teaching - our experience, J Postgrad Med, 40(4), 1994, 231-232.

[2] M. Basu, P. Das, and G. Chowdhury, Introducing integrated teaching and comparison with traditional teaching in undergraduate medical curriculum: A pilot study, Med J DY Patil Univ, 8(4), 2015, 431-438.

[3] Medical Council of India, Regulations on Graduate Medical Education - Amended up to 10th March 2017 ( New Delhi, Medical Council of India, 1997), p. 2.

[4] P. S. Bhuiyan and D. D. Pandit, Integrated teaching, in: P. S. Bhuiyan, N. N. Rege, A. N. Supe (Eds.), The art of teaching medical students (New Delhi: Reed Elsevier, 2015), 370-378.

[5] Z. Hasan, and R. Sequeira, Challenges of Teaching Physiology in an Integrated System-Based Curriculum, Can Med Educ J, 3(1), 2012, e73-e76.

[6] D. L. Taren, C. A. Thomson, N. A. Koff, P. R. Gordon, M. J. Marian, T. L. Bassford, et al. Effect of an integrated nutrition curriculum on medical education, student clinical performance, and student perception of medical-nutrition training, Am J Clin Nutr, 73(6), 2001, 1107-1112.

[7] S. Kireeti, and D. S. Reddy, Case based learning (CBL), a better option to traditional teaching for undergraduate students in curriculum of Paediatrics, Asian J Biomed Pharm Sci, 5(45), 2015, 39-41.

[8] K. E. Bledsoe, Managing problem-based learning in large lecture sections, Biosci Educ, 18, 2011.

[9] G. A. Dunaway, and C. L. Faingold, Development and implementation of a multidisciplinary sophomore medical curriculum: Integration of pharmacology with basic and clinical sciences, Pharmacologist, 43, 2001,:83-90.

[10] G. R. Norman, and H. G. Schmidt, Effectiveness of problem-based learning curricula: theory, practice and paper darts, Med Educ, 34(9), 2000, 729-738.

[11] S. Sathishkumar, N. Thomas, E. Tharion, N. Neelakantan, and R. Vyas, Attitude of medical students towards early clinical exposure in learning endocrine physiology, BMC Med Educ, 7, 2007, 30.

[12] J. K. McDonald, S. C. Yanchar, and R. T. Osguthorpe, Learning from programmed instruction: examining implications for modern instructional technology, Educ Technol Res Dev, 53(2), 2005, 84-98.

[13] M. Molenda, The programmed instruction era: When effectiveness mattered, TechTrends, 52(2), 2008, 53-58.

[14] M. A. Tufts, and S. B. Higgins-Opitz, What makes the learning of physiology in a PBL medical curriculum challenging? Student perceptions, Adv Physiol Educ, 33(3), 2009, 187-195.

[15] M. H. Davis, and R. M. Harden, Planning and implementing an undergraduate medical curriculum: the lessons learned, Med Teach, 25(6), 2003, 596-608.

[16] T. Abdul-Ghaffar, K. Lukowiak, and U. Nayar, Challenges of teaching physiology in a PBL school, Adv Physiol Educ, 22(1), 1999, S140-S147.

[17] D. Kaufman, and K. Mann, Basic sciences in PBL and conventional curricula: Students' attitudes, Med Educ, 31(3), 1997, 171-180.

[18] J. Gale, The integrated curriculum: experiences, achievements and problems, Med Teach, 6(1), 1984, 22-26.

[19] S. R. Kotian, A. S. DSouza, N. P. Bhat, A. DSouza, and M. Hosapatna, Integrated Teaching: Boon or A Bane?!, Online J Health Allied Scs, 15(2), 2016, 6.

[20] V. L. M. Raman, R. K. Solomon, Study on effectiveness of integrated lecture module versus didactic lecture module in learning skills, IOSR-JDMS, 14(1), 2015, 14-16.

[21] N. Rafique, Importance of vertical integration in teaching and assessment of physiological concepts, J Taibah Univ Med Sci, 9(4), 2014, 282-288.

[22] R. Doraisamy, and S. Radhakrishnan, The effectiveness of integrated teaching over traditional teaching among first year MBBS students: A preliminary Study, Med J DY Patil Univ, 6(2), 2013, 139-141.

[23] L. H. Nikam, and S. V. Chopade, Introduction of horizontal integration and comparison with traditional teaching methods in physiology, Int J Basic Med Sci, 3, 2012, 143-147.

[24] V. S. Dandannavar, Effect of integrated teaching versus conventional lecturing on MBBS phase I students, Recent Res Sci Technol, 2(11), 2010, 40-48.

[25] S. Ghosh, and H. V. Pandya, Implementation of integrated learning program in neurosciences during first year of traditional medical course: Perception of students and faculty, BMC Med Educ, 8, 2008, 44.

[26] M. Demirören, S. Turan, and D. Öztuna, Medical students' self-efficacy in problem-based learning and its relationship with self-regulated learning, Med Educ Online, 21, 2016, 30049.

[27] E. A. Wehrwein, H. L. Lujan, and S. E. DiCarlo, Gender differences in learning style preferences among undergraduate physiology students, Adv Physiol Educ, 31(2), 2007, 153-157.
[28] M. Philbin, E. Meier, S. Huffman, and P. Boverie, A survey of gender and learning styles. Sex Roles, 32(7), 1995, 485-494.
[29] S. E. Severiens, and G. T. M. Ten Dam, Gender differences in learning styles: A narrative review and quantitative meta-analysis, High Educ, 27(4), 1994, 487-501.
[30] B. J. Zimmerman, and M. Martinez-Pons, Student differences in self-regulated learning: relating grade, sex, and giftedness to self-efficacy and strategy use, J Educ Psychol, 82, 1990, 51-59.
[31] C. D. Miller, J. Finley, and D. L. McKinley, Learning approaches and motives: Male and female differences and implications for learning assistance programs, J College Student Dev, 31(2), 1990, 147-154.
[32] P. Miller, Learning styles: the multimedia of the mind. Educ Resources Inform Center, 451, 2001, 140.