International Journal of Research in Medical Sciences
Bhattacharya S et al. Int J Res Med Sci. 2019 Apr;7(4):972-976
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20191297

Original Research Article

Outcome of combination of methods of educational interventions in physiology for first-year MBBS students

Srabani Bhattacharya[1], Rucha Wagh[1]*, Sundaram Kartikeyan[2], Aniruddha A. Malgaonkar[2], Sandhya S. Khadse[3]

[1]Department of Physiology, [2]Department of Community Medicine, [3]Dean, Rajiv Gandhi Medical College, Kalwa, Thane, Maharashtra, India

Received: 17 January 2019
Accepted: 01 March 2019

***Correspondence:**
Dr. Rucha Wagh,
E-mail: dr.ruchawagh@gmail.com

ABSTRACT

Background: This comparative, before and after study (without controls) was conducted in a municipal medical college to compare the cognitive domain scores obtained by first-year MBBS students after didactic lectures with that obtained after an educational intervention that combined integrated teaching with clinical scenarios.
Methods: After obtaining prior permissions, the purpose of the study was explained to first-year MBBS students and written informed consent was obtained. After attending curriculum-based didactic lectures on the alimentary system, the students (n=62, females: n=29, 46.77% and males: n=33, 53.23%) took a pre-test comprising ten questions (total 20 marks). After the pre-test, the participants attended an educational intervention that combined integrated teaching with clinical scenarios on the same topic. Subsequently, the post-test was administered using a questionnaire that was identical to that of the pre-test.
Results: The mean overall marks obtained in the pre-test was 14.73±1.87 (95% CI: 14.26-15.19), while that obtained in the post-test was 17.16±1.73 (95% CI: 16.73-17.59), exhibiting highly significant ($p < 0.00001$) difference. The gender difference in scores was significant ($p=0.011$) for only question no. 1 in the pre-test and there was no significant gender difference in the post-test.
Conclusions: A combined method of educational intervention was found to enhance the cognitive domain scores of students. Though a larger study would be needed to generalize the findings, male students seem to need an additional educational intervention to improve their cognitive domain scores. Despite time limitations in the teaching schedule for the first-year MBBS course, integrated teaching with case scenarios can be implemented to impart early clinical exposure.

Keywords: Alimentary system, Case scenarios, Educational intervention, Integrated teaching

INTRODUCTION

Integrated teaching (IT) entails amalgamating teaching material to inter-relate different facets of the same topic that is routinely taught by separate academic departments. Horizontal integration implies merger of teaching in two or more subjects taught alongside in the same phase of the curriculum, while vertical integration is that between subjects taught in the different phases of curriculum.[1] In vertical integration, the customary divide between pre-

clinical and clinical sciences ceases to exist and basic sciences are represented unequivocally in the clinical curriculum and the learning of basic science is placed in the setting of clinical sciences, which is more relevant to students. Curriculum integration typically involves both horizontal and vertical integration. The process of curricular integration can take place at dissimilar rates and some topics are integrated more or less effortlessly, as compared to others.[2] Harden's "integration ladder" visualizes curricular integration as an eleven-step ladder. Subject-based isolated teaching comprises the lower four steps of the ladder. Increasing levels of cross-disciplinary integration are represented in the upper six steps. In the final eleventh step of the ladder, the student takes more responsibility for the integration and is provided with the necessary tools.[3]

IT saves time and efforts of teachers by synchronizing dissemination of information on various subjects, provides learners with a holistic outlook and enables them to comprehend new perspectives, prevents the acquisition of bits of information in isolation and converts knowledge into handy tools for learning new know-how, and enables applied learning and constructive clinical reasoning.[2,4,6] Defining the core curriculum, sequencing content, faculty proficiency and interdisciplinary integration are among the pre-requisites for teaching physiology in an integrated curriculum.[7] In integrated teaching, it is mandatory to include the "must know" basic science component of the curriculum.[8,9]

One fundamental feature of adult learning theory, or andragogy, is that adult learners are willing to learn the subject matter only after they understand its relevance ("meaningful learning").[10,11] First-year medical students with no clinical exposure find it difficult to connect details of basic sciences to clinical scenarios. This challenge is surmounted by linking basic science topics to clinical problems. Knowledge is most effective when the organization of that knowledge matches the way in which the knowledge is to be used.[12] Teaching medical students about basic science in the context of clinical examples by means of integrated presentation of material can add to long-term retention and profound understanding. Clinical examples can assist students in distinguishing facets of basic science concepts that will be of assistance to them as they advance to clinical placements.[13]

The Medical Council of India has recommended IT with clinical relevance to achieve both horizontal and vertical integration in different phases of the Bachelor of Medicine, Bachelor of Surgery (MBBS) course with the purpose of providing medical students with holistic learning perspectives.[14] Early clinical exposure can facilitate first-year medical students to recognize applied aspects of basic sciences and to expand on that knowledge as they progress into clinical education.[15] Blending in actual or hypothetical clinical scenarios while teaching first-year medical students along the lines of clinical scenarios is a student-centred approach that renders learning into a delightful experience, generate interest in a specific topic, assist in establishing a link among concepts, enhance long-term retention, assist recall of prior knowledge when required, bridge the divergence between academic knowledge and its practical application, and bring about deeper understanding among students.[15-18]

The objective of this study was to compare the cognitive domain scores obtained by first-year MBBS students after didactic lectures (by a pre-test) with that obtained after an educational intervention that combined integrated teaching with clinical scenarios (by a post-test).

METHODS

This comparative, before and after study (without controls) was conducted in February 2018 at Rajiv Gandhi Medical College, a Municipal Medical College in Kalwa, Thane, Maharashtra, India. The participants included all first-year MBBS students, of either sex, who gave written informed consent. Those students who did not give written informed consent or those who were absent during the didactic lectures, or the educational intervention, or pre-test or post-test were excluded.

After obtaining prior 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. After curriculum-based didactic lectures were delivered on the alimentary system, the students took a pre-test comprising ten questions (two marks per question, total 20 marks). After the pre-test, the participants attended educational intervention using a combination of integrated teaching with clinical scenarios on the same topic. Subsequently, the post-test was administered using a questionnaire that was identical to that of the pre-test. The outcome studied was the difference in cognitive domain scores after didactic lectures (by a pre-test) and after educational intervention (by a post-test).

The data were presented as mean and standard deviation (SD). 95% Confidence interval (CI) was calculated using the formula: (Mean-(1.96)*Standard Error))-(Mean+(1.96)*Standard Error)). EpiInfo Version 7.0 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA) was used for statistical analyses. The standard error of difference between two means was calculated. Statistical significance was set at $p < 0.05$.

RESULTS

A total of 62 first-year MBBS students (females: n=29, 46.77% and males: n=33, 53.23%) participated in the study. The mean overall marks (out of 20) obtained in the pre-test was 14.73±1.87 (95% CI: 14.26-15.19), while that obtained in the post-test was 17.16±1.73 (95% CI:

16.73-17.59). The difference in the mean overall marks obtained in the pre- and post- tests was highly significant (Z=7.511, p<0.00001). The gender difference in the mean overall marks (out of 20) was statistically significant in the pre-test (Z=3.341, p =0.0008) but was not significant in the post test (Z=0.417, p =0.676) (Table 1).

Table 1: Overall mean marks (out of 20) in pre- and post- tests.

Variables	Pre-test females (n=29)	Pre-test males (n=33)	Post-test females (n=29)	Post-test males (n=33)
Mean±SD	15.03±1.72	13.39±2.15	17.24±1.57	17.06±1.84
95% CI	14.41-15.66	12.66-14.13	16.69-17.87	16.43-17.69
Z value #	3.341		0.417	
p value	0.0008*		0.676	

Standard error of difference between two means, SD = Standard deviation, CI = Confidence interval; *Significant.

Table 2: Question-wise mean marks (out of 2) in the pre-test.

Question no.	Pre-test females (n=29)	Pre-test males (n=33)	Z value #	p value
	Mean±SD	Mean±SD		
1	1.93±0.26	1.58±0.75	2.514	0.011*
2	1.55±0.57	1.45±0.71	0.615	0.538
3	1.31±0.47	1.15±0.36	1.489	0.136
4	1.52±0.51	1.42±0.71	0.642	0.520
5	1.38±0.56	1.36±0.65	0.130	0.896
6	1.52±0.57	1.48±0.67	0.254	0.799
7	1.14±0.44	1.06±0.50	0.670	0.502
8	1.66±0.55	1.45±0.62	1.413	0.157
9	1.31±0.81	0.97±0.77	1.688	0.091
10	1.72±0.53	1.45±0.62	1.849	0.064

Standard error of difference between two means, SD = Standard deviation, *Significant.

Table 3: Question-wise mean marks (out of 2) in the post-test.

Question No.	Post-test Females (n=29)	Post-test Males (n=33)	Z value #	p value
	Mean±SD	Mean±SD		
1	1.90±0.31	1.85±0.36	0.588	0.556
2	1.76±0.51	1.55±0.56	1.545	0.122
3	1.31±0.47	1.52±0.51	1.687	0.091
4	1.97±0.19	1.91±0.29	0.974	0.334
5	1.83±0.38	1.70±0.64	0.986	0.324
6	1.86±0.35	1.88±0.33	0.231	0.817
7	1.55±0.51	1.52±0.62	0.209	0.834
8	1.86±0.35	1.88±0.33	0.231	0.817
9	1.34±0.81	1.55±0.62	1.134	0.256
10	1.86±0.35	1.73±0.45	1.277	0.201

Standard error of difference between two means; SD = Standard deviation.

In the pre-test, the marks in third quartile (16) for female students were the same as that for the maximum marks (16) for males. Likewise, the marks in first quartile (15) for female students were the same as that for the median marks (15) for males. The minimum score was higher for female (10), as compared to that for males (9). In the post-test, the maximum score (20) was identical for students of both sexes. The post-test marks in the third quartile for female students (18) were the same as the median marks for male students (18). The first quartile and minimum score was higher for males, compared with to that for females (Figure 1). In the pre-test, female students obtained higher mean question-wise marks in all the ten questions, the gender difference was statistically significant only in question No. 1 (Z=2.514, p=0.011) (Table 2).

In the post-test, female students had higher mean question-wise marks in six questions, mean marks of male students exceed that of their female counterparts in question Nos. 3, 6, 8, and 9 and the gender difference was not significant (Table 3).

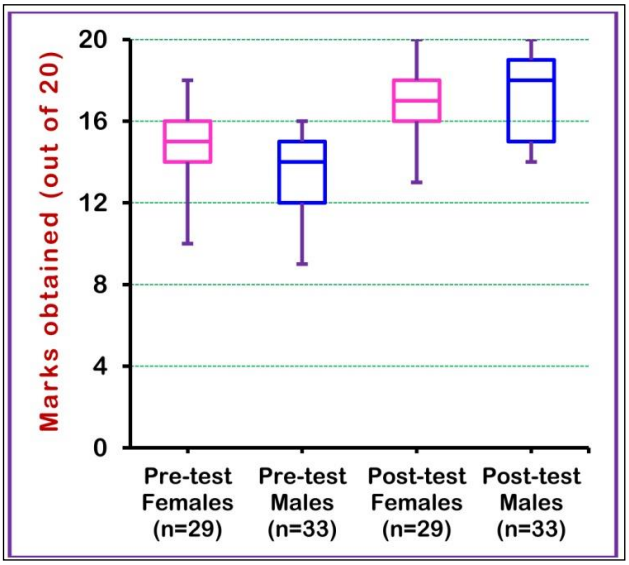

Figure 1: Boxplot of gender-wise scores in pre- and post-tests.

DISCUSSION

Currently, medical education in the India is encumbered by emphasis on didactic lectures, insufficient integration of course material, inadequate synchronization between the departments teaching basic and clinical sciences and repetition of the same topics by teachers of various departments leading to wastage of time and effort.

The present study revealed that the mean marks obtained by students (n=62) in the post-test were significantly higher ($p < 0.00001$) than that obtained in the pre-test. Similar results have also been reported by other studies.[19,20] The gender difference in the mean overall marks was statistically significant in the pre-test but was not significant in the post-test (Table 1). In the present study, a statistically significant gender difference is observed in the pre-test (Table 2). It has been hypothesized that in educational institutions, male behaviour, values and attitudes encumber male's educational accomplishment. 21 After the "extra propulsion" in the form of a combined method of educational intervention, improved the cognitive domain scores for male students, their mean marks exceeded that of their female counterparts in question Nos. 3, 6, 8, and 9 and the overall post-test gender difference was not significant (Table 3). Social conditioning and gender biased environments can have some bearing on academic scores.[22] The gender gap in scores ceases to exist in more gender-equal societies.[23] Both male and female students retain their gender-specific behaviours, attitudes and values, which is an outcome of their socialization in conformity with the existing social norms of masculinity and femininity since their childhood.[24,25] Student's examination scores and their attitude toward learning were found to significantly improve when the instructor's teaching styles were aligned with student learning styles.[26,27] Learning style is an individual's preferred methods for perceiving, processing, storing, and recollecting what they try to learn for transforming their learning experiences.[28,29] More than 70 learning style models have been described.[30] Students of both genders prefer multi-modal learning but learning styles of female students may be more diverse.[31,32] The other factors determining learning style include age, level of education, culture and creative thinking.[33]

In the limitations, generalization of the findings would be hindered because this study was conducted on one batch of 62 first-year medical students. Due to time limitations of the first-year MBBS course, the participants were exposed to clinical scenarios but could not be exposed to real-life patients and a follow-up study could not be done to determine the retention of cognitive domain skills among the participants. A larger study using similar combined educational intervention would be necessary in order to generalize the results.

CONCLUSION

The results of the present study indicated that the additional impetus in the form of a combined method of educational intervention can improve the cognitive domain scores of participating students. Though a larger study would be necessary to generalize the findings, male students seem to need an extra dose of educational intervention to improve their cognitive domain scores. Despite time limitations in the teaching schedule for the first-year MBBS course, integrated teaching with case scenarios can be implemented to impart early clinical exposure.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Basu M, Das P, Chowdhury G. Introducing integrated teaching and comparison with traditional teaching in undergraduate medical curriculum: A pilot study. Med J Dr. DY Patil Univ. 2015;8(4):431.
2. Atwa HS, Gouda EM. Curriculum integration in medical education: a theoretical review. Intellectual Prop Rights Open Access. 2014;2(2):113.
3. Harden RM. The integration ladder: a tool for curriculum planning and evaluation. Med Edu Oxford. 2000;34(7):551-7.
4. Taren DL, Thomson CA, Koff NA, Gordon PR, Marian MJ, Bassford TL, et al. Effect of an

integrated nutrition curriculum on medical education, student clinical performance, and student perception of medical-nutrition training. Am J Clin Nutrition. 2001;73(6):1107-12.
5. Lipson MY, Valencia SW, Wixson KK, Peters CW. Integration and thematic teaching: Integration to improve teaching and learning. Language Arts. 1993;70(4):252-63.
6. Vidic B, Weitlauf HM. Horizontal and vertical integration of academic disciplines in the medical school curriculum. Clin Anatomy Off J Am Assoc Clin Anatomists Brit Assoc Clin Anatomists. 2002;15(3):233-5.
7. Tufts MA, Higgins-Opitz SB. What makes the learning of physiology in a PBL medical curriculum challenging? Student perceptions. Adv Physiol Edu. 2009;33(3):187-95.
8. Hasan Z, Sequeira R. Challenges of teaching physiology in an integrated system-based curriculum. Can Med Edu J. 2012;3(1):e73.
9. Bruner JS. The process of education. Cambridge, MA: Harvard University Press; 1960: 13.
10. Knowles MS. The modern practice of adult education: From pedagogy to andragogy. Chicago, IL: Follett; 1980.
11. Kaufman DM, Mann KV. Teaching and learning in medical education: How theory can inform practice. In: Swanwick T, eds. Understanding medical education: Evidence, theory and practice. West Sussex, UK: Wiley-Blackwell; 2010: 7-30.
12. Ambrose SA, Bridges MW, DiPietro M, Lovett MC, Norman MK. How learning works: Seven research-based principles for smart teaching. San Francisco, CA: Jossey-Bass; 2010.
13. National Research Council. How people learn. Brain, mind, experience, and school: Expanded ed. Washington, DC: The National Academy Press; 2000.
14. Medical Council of India. Regulations on Graduate Medical Education-Amended up to 10th March 2017. New Delhi: Medical Council of India; 2017: 2.
15. Brauer DG, Ferguson KJ. The integrated curriculum in medical education: AMEE Guide No. 96. Med Teacher. 2015;37(4):312-22.
16. Lemos AR, Sandars JE, Alves P, Costa MJ. The evaluation of student-centredness of teaching and learning: a new mixed-methods approach. Int J Med Edu. 2014;5:157.
17. Singh T, Gupta P, Singh D. Principles of medical education. Jaypee Brothers Med Pub; 2013: 22-26.
18. Huber MT, Hutchings P. Integrative Learning: Mapping the Terrain. The Academy in Transition. Assoc Am Coll Univ. 2004:1-17.
19. Raman VL, Raju KS. Study on effectiveness of integrated lecture module versus didactic lecture module in learning skills. J Dental Med Sci. 2015;14:14-6.
20. Ghosh S, Pandya HV. Implementation of integrated learning program in neurosciences during first year of traditional medical course: Perception of students and faculty. BMC Med Edu. 2008;8(1):44.
21. Van Nguyen H, Giang TT. Gender difference in academic planning activity among medical students. Plos One. 2013;8(2):e55845.
22. Halpern DF, Wai J, Saw AA. Psychobiosocial Model: Why females are sometimes greater than and sometimes less than males in math achievement. In: Gallagher AM, Kaufman JC, eds. Gender Differences in Mathematics. New York: Cambridge University Press; 2005: 48-72.
23. Guiso L, Monte F, Sapienza P, Zingales L. Culture, gender and math. Sci. 2008;320(5880):1164-5.
24. Gibb SJ, Fergusson DM, Horwood LJ. Gender differences in educational achievement to age 25. Aus J Edu. 2008;52(1):63-80.
25. Weaver-Hightower M. The "boy turn" in research on gender and education. Rev Edu Res. 2003;73(4):471-98.
26. Saleh A. Brain hemisphericity and academic majors: A correlation study. Coll Student J. 2001;35(2):193-200.
27. Miller JA. Enhancement of achievement and attitudes through individualized learning-style presentations of two allied health courses. J Allied Heal. 1998;27(3):150-6.
28. James WB, Gardner DL. Learning styles: Implications for distance learning. New directions for adult and continuing education. 1995;67:19-31.
29. Mainemelis C, Boyatzis RE, Kolb DA. Learning styles and adaptive flexibility: Testing experiential learning theory. Man Learning. 2002;33(1):5-33.
30. Coffield F, Moseley D, Hall E, Ecclestone K. Learning Styles and Pedagogy in Post-16 Learning: a Systematic and Critical Review. London, England: Learning Skills and Research Centre; 2004.
31. Slater JA, Lujan HL, DiCarlo SE. Does gender influence learning style preferences of first-year medical students?. Adv Physiol Edu. 2007;31(4):336-42.
32. Philbin M, Meier E, Huffman S, Boverie P. A survey of gender and learning styles. Sex Roles. 1995;32(7-8):485-94.
33. Honigsfeld AM. A comparative analysis of the learning styles of adolescents from diverse nations by age, gender, academic achievement level and nationality. Doctoral dissertation. Dissert Abstr Int 2001;62:969.

Cite this article as: Bhattacharya S, Wagh R, Kartikeyan S, Malgaonkar AA, Khadse SS. Outcome of combination of methods of educational interventions in physiology for first-year MBBS students. Int J Res Med Sci 2019;7:972-6.