

ORIGINAL ARTICLE

Effect of Integrated sessions of anatomy and physiology on academic performance: A pilot study

AYESHA HAQUE¹, AYESHA NAVEED², MUHAMMAD IMRAN ASHRAF³, SHAZANA RANA⁴, TAYYIBA IFTIKHAR MIRZA⁵, AYESHA GHASSAN⁶

¹Associate Professor & Head of Department of Anatomy, Dental College, HITEC-Institute of Medical Sciences, Rawalpindi

²Assistant professor, Department of medical education and post graduate training, CMH LMC and IOD

³Associate Professor, Department of Pharmacology, Rai Medical College Sargodha, Pakistan.

⁴Associate Professor, Department of Pharmacology, HITEC-IMS Taxila Cantt. Pakistan.

^{5,6}Assistant Professor, Foundation University Medical College, Islamabad

Correspondence to Dr. Muhammad Imran Ashraf, Email: imipmc@gmail.com

ABSTRACT

Aim: To conduct integrated sessions of anatomy and physiology for ascending tracts and determine its effect on academic performance and determine perceptions of the students regarding its effectiveness.

Methods: Using nonprobability convenience sampling, fifty-three students were selected from first year BDS and were divided into group 1 and 2 comprising of 27 and 26 students respectively. Group 1 learned anatomy and physiology of ascending tracts through four integrated sessions while group 2 was taught same content through traditional teaching sessions. At the end of sessions, knowledge was assessed and compared through a MCQ based exam. Questionnaire based perceptions were gathered about the integrated sessions from the participants belonging to group 1.

Results: The mean score of the students from group 1 (34.8 ± 6.53) was higher than that of group 2 (31.36 ± 5.71) ($P < 0.05$). Most of the students positively perceived this method of teaching and felt that it was more understandable, motivating, interesting and they would prefer this method over traditional teaching.

Conclusion: Integrated sessions for anatomy and physiology of ascending tracts enhanced academic performance and were positively perceived by the students.

Keywords: Anatomy, Physiology, Integration, Medical education, Motivation.

INTRODUCTION

As the field of medical education expands, focus on ways to improve teaching methodology increases. Currently traditional methods of teaching predominate in Pakistan however, the global curricular trend favours horizontal as well as vertical integration.¹ This is because integrated learning enhances conceptual learning and diminishes fragmentation of knowledge^{2,3}. The evidence is documented by better academic performance shown by those exposed to integrated teaching as compared to traditional methods^{3,4}. It has also been shown that traditional learning may not be suitable for most of current medical students being from generation Z (born between 1997-2012) who are likely to organize their schemas according to potential benefits of the information⁵.

During their initial two years students of medicine and dentistry are taught basic subjects. Out of those anatomy and physiology occupy major portion of the syllabus. Being a fundamental discipline anatomy has wide clinical applications and its adequate knowledge is essential for safe clinical practice^{6,7}. However, due to its complexity many students find it cognitively challenging and difficult to grasp. Lack of confidence in anatomical knowledge is a frequent challenge faced by physicians.⁸⁻¹⁰ Physiology is the other basic subject which is perceived as hard to understand due to its difficult concepts¹⁰. Despite being closely related, both of these subjects are taught in isolation under traditional system. Where anatomy is concerned with the external and internal morphology, physiology is concerned with the functions of those structures. If taught in integration the students may find the mutual relevance easier to comprehend and this may help them with understanding of difficult concepts associated with these subjects. Integration is widely advocated because of its ability to establish links between disciplines and to enhance learning¹.

For this purpose, a preliminary study was initiated through which we are presenting an approach based on our experience for integrated curriculum for the basic disciplines of anatomy and physiology.

METHODS

After obtaining ethical approval from the Institutional Review Board a comparative analysis was conducted at the Dental College,

HITEC-IMS, Taxila Rawalpindi, Pakistan during the first week of August 2021. All of the students completing first year of their BDS program at the dental college were invited to participate. Open Epi calculator was used to calculate the sample size. With power of the test at 80% and confidence level of 95%, the mean \pm SD for first group was $=24.1 \pm 4.26$ and 30.96 ± 6.23 for the second group.¹¹ The sample size for this study was 53. Random sampling was used to assign the participants to two groups group 1 ($n=27$) and group 2($n=26$).

After several discussions among the heads of the departments of anatomy and physiology a plan was devised to deliver lectures on anatomy and physiology of ascending tracts in integration. A pre-test was conducted for both groups to assess previous knowledge. The score for pre-test did not differ significantly between the groups ($p > 0.05$), therefore, it was not included in final calculations.

Participants of group 1 were exposed to integrated teaching and syllabus was covered in four consecutive lectures. For the delivery of content isolated interacting element effect of intrinsic load was used.¹² Following this effect, lecture was started by describing the anatomy and physiology of the ascending tracts in isolation by the respective head of the departments. This was to build prior knowledge of the content. After that, topics were summarized as a whole with emphasising the connection between the morphology and function. The lectures were delivered as a single presentation and teachers followed allocated time slots. Group 2 students were taught through the usual traditional lectures for anatomy ($n=2$) and physiology ($n=2$). After completion of all sessions, knowledge and retention was assessed through a MCQ based exam. Mean score for the groups was compared by applying independent samples, t-test. Significance was considered to be at $p < 0.05$.

To assess the perceptions about this method of teaching, a questionnaire was designed according to a similar previous study, piloted and administered to group 1.¹³

RESULTS

All participating students ($n=53$) were enrolled in first year of dentistry program (BDS) at Dental College HITEC-IMS. Demographics of the study sample is shown in the table 1. The mean age for the participants was 19 ± 2.8 years. The number of female participants was 44 (80%) and males were 9(20%). Majority of the participants belonged to the province of Punjab followed by

from Khyber Pakhtunkhwa, Sindh, and Baluchistan (Table 1). The end of session exam result shows that the mean score of the experimental group 1 (34.8 ± 6.53) was more than that of the control group 2 (31.36 ± 5.71) ($P < 0.05$) (Table-2).

Figure-1 shows the percentage responses of the questionnaire items. Results indicate that more than 70% of the group 1 participants preferred this integrated teaching method to traditional. They considered this as a better experience, content was more understandable, and they were more interested to learn. More than 60% of those students thought that they were more motivated to learn and were able to integrate the content better.

Table-1: Demographics of the study sample

Characteristic	Participants
Gender	
Male	9(20%)
Female	44(80%)
Education	
F.Sc	50(54%)
A Level	3(6%)
Ethnicity	
Punjabi	29(54%)
Pathan	13(25%)
Urdu speaking	8(15%)
Baloch	2(4%)
Sindhi	1(2%)

Table 2: Comparison of Academic Performance of the group-1 and control group 2 (n=50)

Sample	n	Mean score	Std. deviation
Group-1	27 (51)	34.8	6.53
Group-2	26 (49)	31.36	5.71

P value 0.04*

DISCUSSION

Anatomy and physiology are considered relevant but difficult subjects and teachers find it hard to motivate students to learn them^{9,10,14}. The aim of this study was to integrate their teaching to highlight their relevance in a way that could drive students to learn these basic subjects better. Through this study, we have shown that the integrative lecture for anatomy and physiology of the ascending tracts was effective and was successfully administered in first year of BDS course. Furthermore, our results show that this approach increased the academic score and students perceived it as a positive experience.

These findings are in accordance with previous studies which document better academic performance achieved by integrating teaching^{3,4}. Higher marks scored by group 1 in our sample of participants can be attributed to a number of factors. First, integration may have led to decreased extraneous and intrinsic cognitive load which has shown to enhance academic achievement^{15,16}. Presentation of lecture in integrated form places less burden on the brain as there is no need to mentally integrate concepts. In traditional lectures the content is delivered in isolation and the learner has to integrate concepts mentally which places excessive extrinsic cognitive load.¹⁷ According to cognitive load theory, there is limited capacity in working memory which has to accommodate extrinsic, intrinsic and germane cognitive load. Germane load is essential for learning to occur. Therefore, the aim of medical educationists is to devise strategies to minimize extrinsic and intrinsic load to accommodate germane load.¹⁸ Through integrating anatomy and physiology of ascending tracts, intrinsic load for group 1 students must have decreased as they did not require to mentally construct the connection between structure and its function. The content was organized based on isolated interacting element effect of intrinsic load.¹² Following this strategy, content of individual subjects was delivered first in isolation and then summarized holistically so that the students can make the connection between them based on prior knowledge of individual components.¹² Due to well organized delivery, extrinsic cognitive load might also have been decreased leaving more space for

germane load. Maximizing germane load might have led to better retention and higher score by group 1 as compared to group 2 (Table 2).

Our results show that the students felt more motivated to learn through integrated lecture. This may have resulted from the novelty of teaching method. Studies show that when new methodology is used it arouses curiosity to learn more. Most of the students perceived this session as a positive experience. They felt that this method improved their understanding of the content, and they were more interested to learn. These results are also in agreement with previous studies.^{3,13} Doraisamy et al showed that integrated teaching leads to better understanding and interest as compared to when learning is disjointed. He indicated that integrating these subjects improves cognition and eliminates fear of the topic which may be perceived as positive experience by the students. In another study, Singh et al integrated anatomy and physiology in a session of autonomic nervous system teaching and showed that students preferred this method of teaching because it motivated them to learn and was more efficient.

The implementation of integrated teaching is supported by the principles of learning however, most of the institutions in Pakistan practice traditional or hybrid curricula. The teaching of anatomy and physiology are still largely compartmentalized. This may be because integration is a time intensive and laborious process. Extra effort is required to prepare plan and deliver the integrated content. Heavy workload and limited number of available faculty further challenges the execution of integrated curriculum. However, teachers need to use innovative and creative ways to teach anatomy. This study presents a feasible way to integrate which may guide decisions by policy makers to integrate relevant basic subjects to improve learning.

CONCLUSION

Integrated teaching sessions for anatomy and physiology of ascending tracts showed to enhance academic performance and were well perceived by the students. Results of this study could guide policies as the shift to integrated curriculum becomes imminent.

Conflict of interest: Nil

REFERENCES

1. Akram A, Rizwan F, Sattar K, Hadi JIS, Meo SA. An approach for developing integrated undergraduate medical curriculum. *Pak J Med Sci*. 2018;34(4):804-810. doi:10.12669/pjms.344.14565
2. Vidic B, Weitlauf HM. Horizontal and vertical integration of academic disciplines in the medical school curriculum. *Clin Anat*. 2002;15(3):233-5.
3. Doraisamy R, Radhakrishnan S. The effectiveness of integrated teaching over traditional teaching among first year MBBS students: a preliminary study. *Medical J Dr DY Patil University*. 2013;6(2):139.
4. Kate MS, Kulkarni UJ, Supe A, Deshmukh Y. Introducing integrated teaching in undergraduate medical curriculum. *Int J Pharm Sci Res*. 2010;1(1):18-22.
5. Eckleberry-Hunt J, Lick D, Hunt R. Is Medical Education Ready for Generation Z? *J Grad Med Educ*. 2018 Aug;10(4):378-381. doi: 10.4300/JGME-D-18-00466.1.
6. Turney BW. Anatomy in a modern medical curriculum. *Ann R Coll Surg Engl* 2007; 89(2): 104-107.
7. Atlasi MA, Moravveji A, Nikzad H, Mehrabadi V, Naderian H. Learning styles and strategies preferences of Iranian medical students in gross anatomy courses and their correlations with gender. *Anat Cell Biol* 2017; 50(4): 255-260.
8. Fillmore EP, Brokaw JJ, Kochhar K, Nalin PM. Understanding the current anatomical competence landscape: Comparing perceptions of program directors, residents, and fourth-year medical students. *Anat Sci Educ* 2016; 9(4): 307-318.
9. Cheung CC, Bridges SM, Tipoe GL. Why is Anatomy Difficult to Learn? The Implications for Undergraduate Medical Curricula. *Anat Sci Educ*. 2021 Nov;14(6):752-763. doi: 10.1002/ase.2071. Epub 2021 Apr 2. PMID: 33720515.

10. Slominski T, Grindberg S, Momsen J. Physiology is hard: a replication study of students' perceived learning difficulties. *Adv Physiol Educ.* 2019 Jun 1;43(2):121-127. doi: 10.1152/advan.00040.2018.
11. Qamar K, Ahmad A, Ashar A. Comparison of learning anatomy with cadaveric dissection and plastic models by medical students. *Pak Armed Forces Med J* 2014; 64(2): 219-224.
12. Talip SB, Mohd Ismail ZI, Hadie SNH. Investigating the benefits of integrated anatomy instruction: a cognitive load theory perspective. *Education in Medicine Journal.* 2021;13(3):1-14. <https://doi.org/10.21315/eimj2021.13.3.1>
13. Singh A, Min AK, Ghosh S. Integrated interactive lecture in the early blocks of 1st year medical students: A pilot study. *Med J DY Patil Univ* 2016;9:484-8.
14. Estai M, Bunt S. Best teaching practices in anatomy education: a critical review. *Ann Anat.* 2016;208:151-7. <https://doi.org/10.1016/j.aanat.2016.02.010>
15. Schoenherr DT, Dereski MO, Bernacki KD, Khayyata S, Attardi SM. Development and evaluation of an online integrative histology module: simple design, low-cost, and improves pathology self-efficacy. *Med Educ Online.* 2022;27(1):2011692. doi:10.1080/10872981.2021.2011692
16. Rao Bhagavathula V, Bhagavathula V, Moinis RS, Chaudhuri JD. The Integration of Prelaboratory Assignments within Neuroanatomy Augment Academic Performance, Increase Engagement, and Enhance Intrinsic Motivation in Students. *Anat Sci Educ.* 2021 Apr 8. doi: 10.1002/ase.2084.
17. Jordan J, Wagner J, Manthey DE, Wolff M, Santen S, Cico SJ. Optimizing Lectures From a Cognitive Load Perspective. *AEM Educ Train.* 2019;4(3):306-312. doi:10.1002/aet2.10389
18. Young JQ, Van Merriënboer J, Durning S, Ten Cate O. Cognitive Load Theory: implications for medical education: AMEE Guide No. 86. *Med Teach.* 2014 May;36(5):371-84. doi: 10.3109/0142159X.2014.889290.