ORIGINAL RESEARCH PAPER

Anatomy

EXPLORING THE IMPACT OF VERTICAL INTEGRATED TEACHING ON CONCEPTUAL UNDERSTANDING AND CLINICAL REASONING: A MIXED-METHODS STUDY AMONG UNDERGRADUATE MEDICAL STUDENTS

KEY WORDS: Vertical integration, mixed-methods, medical education, anatomy teaching, clinical reasoning

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ABSTRACT

Background: Vertical integration in competency-based medical education aims to bridge the gap between basic sciences and clinical application **Objective**: To evaluate the impact of vertically integrated teaching (Anatomy with Surgery) on conceptual understanding, clinical reasoning, and student engagement. **Methods:** A mixed-methods interventional study was conducted among MBBS Phase I students. Quantitative data were collected using a structured Likert-scale questionnaire, while qualitative data were obtained through reflective writing. Quantitative data were analyzed descriptively, and qualitative data underwent thematic analysis using Braun and Clarke's framework. **Results:** A total of 86 students participated. Over 85% of students agreed or strongly agreed that vertical integration improved understanding, clinical reasoning, and engagement. Thematic analysis revealed seven major themes: conceptual clarity, clinical reasoning, interdisciplinary learning, awareness, engagement, professional development, and future application **Conclusion:** Vertical integration significantly enhances meaningful learning, early clinical orientation, and professional identity formation, supporting its inclusion in undergraduate medical curricula.

INTRODUCTION

Traditional medical education often separates basic sciences from clinical practice, leading to fragmented understanding. Vertical integration aims to address this gap by linking foundational knowledge with clinical application early in training.[1-3]

Competency-based medical education (CBME) emphasizes not only knowledge acquisition but also its application in patient care. However, students frequently struggle to apply anatomical knowledge in clinical settings such as surgery.[4-6]

Topics like venous drainage of the lower limb become clinically meaningful when integrated with conditions such as varicose veins and deep vein thrombosis. This study evaluates the effectiveness of vertical integration in enhancing learning outcomes among MBBS students, in line with recent work on vertical integration in medical education curricula.[1,5].

Methods

The study was conducted after obtaining clearance from the Institutional Ethics Committee and Research Advisory Committee of Dr. RKG Medical College. It was designed as a mixed-methods interventional prospective study and carried out among Phase I MBBS students (n = 86) of the 2023 batch in the Department of Anatomy at Dr. Radhakrishnan Government Medical College, Hamirpur, Himachal Pradesh, India, during the academic year 2023–2024. Both students and faculty were sensitized to the objectives and methodology of the study and consent was taken. Faculty members from the Departments of Anatomy and Surgery participated in its implementation. The intervention focused on the topic of varicose veins (AN20.5) as a clinically applied aspect of the venous drainage of the lower limb. It was structured into two phases: a pre-integration phase (P1) of one hour, involving conventional anatomy teaching, followed by a post-integration phase (P2) of 30 minutes, which incorporated surgical correlation to facilitate vertical integration. A structured lesson plan for this integrated topic was developed by the participating faculty.

Data collection included both quantitative and qualitative components. A questionnaire for feedback from students and faculty was designed and validated by four faculty members of the institution. Quantitative data were obtained using a structured 5-point Likert scale questionnaire assessing students' perceptions of learning, engagement, and effectiveness of the integrated approach. An MCQ test comprising of 10 MCQ related to the topic was also taken immediately after the test. Qualitative data were collected through reflective writing exercises guided by three prompts: "What did you learn?", "So what does it imply?", and "Now what will you do?".

Quantitative data were analyzed using descriptive statistics, expressed as percentages. Qualitative data were analyzed using thematic analysis as described by Braun and Clarke [7], following systematic coding and theme development. Trustworthiness of the qualitative findings was ensured through credibility (use of direct student quotations), dependability (systematic and consistent coding), and confirmability (derivation of themes directly from data).

PERFORMA- VENOUS DRAINAGE OF LOWER LIMB APPLIED ANATOMY							
FEED BACK PROFORMA							
S.No	VALUE		Likert's Scale (%age of students/faculty)				
			Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	Will it motivate the student to study and FEEDBACK understand the topic better	STUDENTS	3.4%	1.16 %	4. 6%	48.8 %	41.8%
		FACULTY	0%	0%	0%	0%	100%
2	Will it help students to integrate basic Sciences with clinical subjects	STUDENTS	2.3%	0%	5.81%	38.37 %	53.54 %
		FACULTY	0%	0%	0%	0%	100%
3	Will it Improve concepts, reasoning and critical thinking skill	STUDENTS	2.3%	0%	4.6%	46.51 %	46.51 %
		FACULTY	0%	0%	0%	0%	100%

4	Does it engage students more and decreases monotony	STUDENTS	2.3%	0%	13.9%	48.8 %	34%
		FACULTY	0%	0%	0%	16.6 %	83.3%
5	Is it a useful Teaching-Learning Method	STUDENTS	2.3%	2.3%	2.3%	46.51 %	46.51 %
		FACULTY	0%	0%	0%	33.3 %	66.6%
6	Is it feasible to implement	FACULTY	0%	0%	0%	66.6 %	33.3%
7	Is it worthy of time used for preparation and implementation	FACULTY	0%	0%	0%	66.6 %	33.3%

RESULTS

PERFORMA- VENOUS DRAINAGE OF LOWER LIMB APPLIED ANATOMY
FEED BACK PROFORMAS.No VALUE
Likert's Scale (%age of students/faculty)

Strongly disagreeDisagree Neutral Agree Strongly agree 1 Will it motivate the student to study and FEEDBACK understand the topic better STUDENTS3.4%1.16% 4. 6% 48.8% 41.8%

FACULTY0%0%0%0%100%2 Will it help students to integrate basic Sciences with clinical subjects STUDENTS2.3% 0%5.81% 38.37% 53.54%

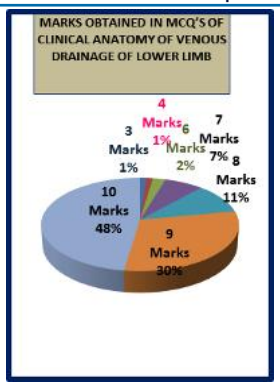
FACULTY0%0%0%0%100%3 Will it Improve concepts, reasoning and critical thinking skill STUDENTS2.3%0%4.6% 46.51% 46.51%

FACULTY0%0%0%0%100%4 Does it engage students more and decreases monotony STUDENTS2.3%0%13.9% 48.8% 34%

FACULTY0%0%0%16.6% 83.3% 5 Is it a useful Teaching-Learning Method STUDENTS2.3%2.3% 2.3% 46.51% 46.51%

FACULTY0%0%0%33.3% 66.6% 6Is it feasible to implement FACULTY0%0%0%66.6% 33.3% 7Is it worthy of time used for preparation and implementation FACULTY0%0%0%66.6% 33.3% The quantitative findings indicated a strong positive perception of vertical integration among students. Approximately 90% of students agreed or strongly agreed that integration improved

The quantitative findings indicated a strong positive perception of vertical integration among students. Approximately 90% of students agreed or strongly agreed that integration improved their understanding of the topic, while about 92% reported enhanced integration of basic and clinical sciences. Around 93% perceived improvements in conceptual clarity and critical thinking. Engagement levels were also high, with nearly 82% of students finding the sessions more engaging compared to traditional teaching methods. Furthermore, approximately 93% rated the integrated approach as an effective teaching-learning strategy, and 78% of students achieved scores of 8 or above out of 10 in the post-session evaluation. Faculty feedback corroborated these findings, with all participating faculty members agreeing that vertical integration improved student understanding and enhanced clinical reasoning. Additionally, 83% of faculty reported improved student engagement, and the majority considered the approach both feasible and worthwhile within the existing curriculum framework.



DISCUSSION

The findings of this study demonstrate that vertical integration significantly enhances both cognitive and affective domains of learning among undergraduate medical students. The findings of this study are consistent with established educational frameworks, including Harden's integration ladder, which emphasizes curriculum alignment and progression toward full integration across disciplines. (8-10) Kolb's experiential learning theory further supports these results, as applied learning through clinical correlation enhances retention and reasoning. (3, 11) Additionally, the findings are consistent with the work of Brauer and Ferguson (2), who advocate for integrated curricula in medical education.

The observed improvement in clinical reasoning suggests early development of diagnostic thinking, which is essential for the training of Indian Medical Graduates. The qualitative themes further reinforce that integrated teaching fosters contextual, meaningful, and professionally relevant learning. This approach facilitates a shift from passive knowledge acquisition to active, application-based learning, thereby enhancing the overall educational experience.

CONCLUSION

Vertical integration emerges as an effective teaching-learning strategy that enhances conceptual understanding, promotes clinical reasoning, and encourages interdisciplinary learning. It also improves student engagement and contributes to professional identity formation. These findings support the incorporation of vertically integrated teaching approaches within undergraduate medical curricula to better prepare students for clinical practice.

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