OPEN ACCESS

Scholars International Journal of Anatomy and Physiology
Abbreviated Key Title: Sch Int J Anat Physiol
ISSN 2616-8618 (Print) |ISSN 2617-345X (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Original Research Article

Ability of Undergraduate Medical Students to Answer Clinically Oriented Multiple-Choice Questions Compared to Non-Clinical Ones on Regional Anatomy

Dr. Abdul Khalek[1]*, Dr. Nargis Sultana[2], Dr. Huzaifa Khanam[3], Dr. Fatema Islam[4], Dr. Nilima Afroz[5]

[1]Lecturer, Department of Anatomy, Bangladesh Medical College, Dhaka, Bangladesh
[2]Assistant Professor, Department of Anatomy, Bangladesh Medical College, Dhaka, Bangladesh
[3]Assistant Professor, Department of Anatomy, South Apollo Medical College, Barisal, Bangladesh
[4]Lecturer, Department of Anatomy, Sir Salimullah Medical College, Dhaka, Bangladesh
[5]Ex lecturer, Department of Anatomy, M H Samorita Medical College, Dhaka, Bangladesh

DOI: https://doi.org/10.36348/sijap.2025.v08i06.002 | **Received:** 23.09.2025 | **Accepted:** 20.11.2025 | **Published:** 25.11.2025

***Corresponding author:** Dr. Abdul Khalek
Lecturer, Department of Anatomy, Bangladesh Medical College, Dhaka, Bangladesh

Abstract

Background: Anatomy is a foundational component of medical education. However, many students find it challenging to apply anatomical knowledge in clinical problem-solving. Understanding their ability to interpret clinical scenarios during the pre-clinical phase can help identify educational gaps. This study evaluated the ability of undergraduate medical students to answer clinically oriented multiple-choice questions (MCQs) compared with non-clinical ones in regional anatomy, and compared performances between first- and second-year students. ***Methods:*** A cross-sectional analytical study was conducted among 220 Phase-I MBBS students (110 first-year and 110 second-year) in a government medical college in Dhaka, Bangladesh, from July 2022 to June 2023. Students were randomly assigned into clinical and non-clinical groups (n=55 each per year). Two validated sets of 10 MCQs were prepared from Snell's Clinical Anatomy by Regions (10th edition), reflecting either clinically applied or descriptive content. Scores for correct, incorrect, and unattempted responses were compared using independent sample t-tests in SPSS version 25. ***Results:*** Non-clinical groups in both years achieved significantly higher mean scores than clinical groups ($p<0.001$). First-year non-clinical students scored 45.45±1.84 versus 37.02±2.95 in the clinical group, while second-year non-clinical students scored 42.89±2.84 versus 37.11±1.88 in the clinical group. Differences between first- and second-year clinical groups were not significant, but first-year non-clinical students performed slightly better than their second-year counterparts ($p<0.05$). ***Conclusion:*** Students demonstrated stronger factual knowledge than applied understanding. Early incorporation of clinical relevance in anatomy teaching, supported by case-based and interdisciplinary approaches, is recommended to enhance clinical reasoning.

Keywords: Anatomy education, clinical integration, medical students, regional anatomy.

INTRODUCTION

Medical education has undergone a significant transformation in recent decades, driven by shifts in pedagogical philosophy, technological development, and evolving expectations of clinical competence. Contemporary curricula increasingly emphasize integrated and system-based approaches, which have reshaped how foundational subjects such as anatomy are taught and learned [1]. Changes in instructional strategies, coupled with new forms of assessment, reflect the growing recognition that effective medical education requires not only knowledge acquisition but also the ability to apply that knowledge in clinically meaningful contexts [2]. These developments are particularly relevant for anatomy; a subject long regarded as the structural basis of medical science and an essential prerequisite for competent clinical practice.

In Bangladesh, the undergraduate medical curriculum has undergone substantial revision since its initial development in 1988 under UNDP and WHO support. Following evaluation and identification of pedagogical gaps, updated curricula were implemented in 2002, 2012, and most recently in 2021, each introducing refinements in both teaching and assessment

methods [3]. A major shift in the 2002 curriculum was the replacement of predominantly essay-type examinations with structured written formats, including short answer questions (SAQs) and multiple-choice questions (MCQs), to enhance objectivity, improve content coverage, and minimize scoring bias. The 2012 and 2021 curricula further strengthened this approach, mandating written examinations composed of 70% SAQs and 20% MCQs, with an additional 10% drawn from formative assessments [4]. MCQs, especially the multiple true–false type recommended in the national curriculum, offer a broad sampling of content, consistent scoring, and efficient administration, making them a preferred tool for evaluating students performance in large cohorts [5].

Anatomy occupies a central position in Phase I of the MBBS curriculum, which encompasses the first 18 months of undergraduate medical education. As a foundational discipline, anatomy supports not only early biomedical learning but also the clinical reasoning required throughout medical training. A sound understanding of structural relationships is indispensable for physical examination, radiologic interpretation, surgical procedures, and clinical decision-making [6]. Because of this wide-ranging relevance, anatomists and clinicians consistently emphasize that anatomy must be taught within a clinically meaningful framework to ensure that students appreciate its applied value rather than memorizing isolated facts [7]. Clinical anatomy, which connects structural knowledge to patient care, serves as a bridge between the preclinical and clinical phases of medical education [8].

The debate over how anatomy should be taught remains active, but consensus highlights the importance of linking anatomical knowledge with clinical application [9]. Regional anatomy, as presented in standard texts such as Snell's Clinical Anatomy by Regions (10th ed., 2012), is organized around anatomical divisions of the body and emphasizes the relationships among structures within a specific area, making it naturally suited for clinically oriented teaching [10]. Integrating clinical correlations into regional anatomy instruction enhances motivation, improves retention, and supports the transition from preclinical learning to clinical practice.

Assessment plays a powerful role in shaping students learning behavior, and constructive alignment between learning objectives, teaching methods, and examination formats is essential [11]. In the undergraduate medical curriculum of Bangladesh, assessment strategies are designed to test cognitive levels across Bloom's taxonomy, with MCQs and SAQs targeting recall, understanding, and application [4]. When assessments incorporate clinically oriented contexts, they encourage students to integrate structural knowledge with its functional and clinical implications. Conversely, assessments that are predominantly factual may inadvertently reinforce rote learning rather than conceptual understanding [12].

Previous studies conducted in Bangladesh and abroad have shown that undergraduate students often perform better on non-clinical or descriptive anatomy questions than on clinically oriented ones. Research in neuroanatomy, physiology, and regional anatomy consistently showed lower scores on applied or clinically contextualized questions compared with non-clinical questions, highlighting a gap between factual knowledge and its application [13,14]. These findings raise important questions about curricular implementation, teaching strategies, and the adequacy of clinical integration during the preclinical phase.

Given the curricular emphasis on clinically oriented teaching and assessment, it is essential to evaluate whether students are sufficiently prepared to answer clinically contextualized questions in anatomy. Understanding their performance patterns may help educators refine instructional strategies, align assessment practices with learning objectives, and strengthen the integration of applied anatomy in Phase I. This study, therefore, aims to assess the ability of undergraduate medical students to answer clinically oriented multiple-choice questions compared to non-clinical ones on regional anatomy.

MATERIALS & METHODS

This cross-sectional analytical study was conducted in a government medical college in Dhaka, Bangladesh, from July 2022 to June 2023. The study population comprised Phase I MBBS students enrolled at the University of Dhaka. Students who had completed Term I and Term II examinations were designated as first-year students, whereas those who had just appeared in the First Professional MBBS Examination (November 2022) were considered second-year students. Participants were divided into two assessment groups: one answered clinically oriented MCQs, and the other answered non-clinical MCQs. Each academic year included two subgroups (first-year clinical and non-clinical; second-year clinical and non-clinical).

Sample Selection

Inclusion Criteria:

- First-year MBBS students were present during the data collection session.
- Second-year MBBS students who had appeared in the First Professional MBBS Examination (November 2022).

Exclusion Criteria:

- Students who were absent on the day of the assessment.
- Students who did not appear in the First Professional Examination.

Data Collection Procedure

Data were collected through a structured written test developed by the researcher. Two question sets were prepared for each academic year, derived from Snell's Clinical Anatomy by Regions (10th edition, 2012), the standard undergraduate textbook in Bangladesh. Each set contained 10 multiples true–false type MCQs designed according to the Bangladesh Medical and Dental Council (BMDC) MBBS curriculum.

Clinically oriented questions were constructed from the "Clinical Notes" sections of the textbook, emphasizing applied anatomical concepts and correlations with clinical conditions. Non-clinical questions were prepared from descriptive sections that lacked clinical context. Developmental, microscopic, radiological, and surface anatomy topics were excluded.

To ensure content validity and balanced distribution, the textbook chapters were divided into five anatomical compartments—Thorax, Abdomen, Superior Extremity, Inferior Extremity, and Head & Neck. Questions were randomly selected from these compartments based on the proportional clinical hours allocated in the BMDC curriculum (e.g., Thorax 21%, Abdomen 42%). Clinical and non-clinical texts were numbered sequentially, and selections were made through a lottery method to maintain randomization and prevent bias.

Each question consisted of five statements, each requiring a true/false response. The items were reviewed independently by two senior anatomists for clarity, content relevance, and accuracy. Necessary revisions were incorporated before finalization.

On the assessment day, the researcher provided standardized instructions to all participants. The MCQ test was conducted under examination conditions and completed within 10 minutes. Each correct answer was awarded one mark, while incorrect or unattempted responses scored zero. All answer sheets were collected immediately after completion. The responses were manually checked, coded, and entered into Microsoft Excel before statistical analysis.

Ethical Considerations

Ethical approval for this study was obtained from the Research Review Committee (RRC) and the Ethical Review Committee (ERC) of Dhaka Medical College. All participants received a detailed explanation of the study objectives and procedures, and written informed consent was obtained before participation. Confidentiality of participants' identities and data was strictly maintained. Participation was voluntary, and no academic advantage or penalty was associated with participation. The study complied with the ethical principles outlined in the Declaration of Helsinki (2013).

Statistical Analysis

Collected data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 25.0 and verified with Microsoft Excel. Descriptive statistics, including means and standard deviations, were computed for quantitative variables. The mean scores between clinical and non-clinical groups within each academic year were compared using the independent samples t-test. Statistical significance was set at a p-value < 0.05, and all tests were conducted at a 95% confidence level.

RESULTS

Table 1: Distribution of participants by academic year and group (n=220)

Academic Year	Clinical Group	Non-Clinical Group	Total
1st Year	55	55	110
2nd Year	55	55	110
Total	**110**	**110**	**220**

A total of 220 students participated—110 first-year and 110 second-year medical students—each equally divided into clinical and non-clinical groups.

Table 2: Comparison of first-year students' performance between clinical and non-clinical groups (n=110)

Response type	Clinical group (Mean ± SD)	Non-clinical group (Mean ± SD)	p-value
Correct answers	37.02 ± 2.95	45.45 ± 1.84	<0.001
Incorrect answers	12.25 ± 2.80	3.89 ± 1.98	<0.001
Unattempted questions	0.73 ± 0.80	0.65 ± 0.82	0.640

A total of 55 first-year undergraduate medical students answered 10 clinically oriented MCQs and another 55 answered 10 non-clinically oriented MCQs on Regional Anatomy. Mean ± SD correct scores were 45.45 ± 1.84 (non-clinical) and 37.02 ± 2.95 (clinical), with significantly lower performance on clinical items. Mean incorrect scores were 3.89 ± 1.98 (non-clinical) and 12.25 ± 2.80 (clinical), indicating significantly more errors on clinical items. Mean unattempted scores were 0.65 ± 0.82 (non-clinical) and 0.73 ± 0.80 (clinical), with no significant difference. Overall, students performed notably worse on clinically oriented questions.

Table 3: Comparison of second-year students' performance between clinical and non-clinical groups (n=110)

Response type	Clinical group (Mean ± SD)	Non-clinical group (Mean ± SD)	p-value
Correct answers	37.11 ± 1.88	42.89 ± 2.84	<0.001
Incorrect answers	12.22 ± 2.17	6.35 ± 2.91	<0.001
Unattempted questions	0.67 ± 0.82	0.76 ± 0.84	0.566

A total of 55 undergraduate medical students of the 2nd year (clinical group) faced 10 clinically oriented multiple-choice questions on Regional Anatomy. Another 55 (non-clinical group) tried to answer 10 non-clinically oriented multiple-choice questions. Mean ± SD scores for correct responses were 42.89 ± 2.84 (non-clinical) and 37.11 ± 1.88 (clinical), with significantly higher accuracy on non-clinical items. Incorrect responses averaged 6.35 ± 2.91 and 12.22 ± 2.17, respectively, indicating significantly more errors on clinical items. Unattempted responses were 0.76 ± 0.84 and 0.67 ± 0.82, with no significant difference. Overall, second-year students performed better on non-clinically oriented MCQs than on clinically oriented ones.

Table 4: Comparison between clinical groups of first- and second-year students (n=110)

Response type	1st Year Clinical (Mean ± SD)	2nd Year Clinical (Mean ± SD)	p-value
Correct answers	37.02 ± 2.95	37.11 ± 1.88	0.847
Incorrect answers	12.25 ± 2.80	12.22 ± 2.17	0.939
Unattempted questions	0.73 ± 0.80	0.67 ± 0.82	0.725

Performance on clinically oriented MCQs was compared between first- and second-year clinical groups. Mean ± SD correct scores were 37.02 ± 2.95 and 37.11 ± 1.88, with slightly lower accuracy in the first-year group. Mean incorrect scores were 12.25 ± 2.80 and 12.22 ± 2.17, and unattempted scores were 0.73 ± 0.80 and 0.67 ± 0.82, both marginally higher in the first-year group. No statistically significant differences were observed, indicating comparable performance between the two cohorts.

Table 5: Comparison between non-clinical groups of first- and second-year students (n=110)

Response type	1st Year Non-Clinical (Mean ± SD)	2nd Year Non-Clinical (Mean ± SD)	p-value
Correct answers	45.45 ± 1.84	42.89 ± 2.84	<0.001
Incorrect answers	3.89 ± 1.98	6.35 ± 2.19	<0.001
Unattempted questions	0.65 ± 0.82	0.76 ± 0.84	0.492

Performance on non-clinically oriented MCQs was compared between first- and second-year non-clinical groups. Mean ± SD correct scores were 45.45 ± 1.84 and 42.89 ± 2.84, with significantly higher accuracy in the first-year group. Incorrect responses averaged 3.89 ± 1.98 and 6.35 ± 2.91, respectively, indicating significantly fewer errors among first-year students. Unattempted responses were 0.65 ± 0.82 and 0.76 ± 0.84, with no significant difference. Overall, first-year students performed better on non-clinically oriented MCQs.

DISCUSSION

The present study evaluated the ability of undergraduate medical students to answer clinically oriented MCQs compared with non-clinical ones in regional anatomy. The findings revealed that students performed significantly better on non-clinical questions than on clinically oriented ones across both first- and second-year cohorts. These results clearly indicate a gap between the acquisition of factual anatomical knowledge and its application in clinical scenarios.

The superior performance on non-clinical MCQs is consistent with previous studies, which have shown that early-phase students often excel in descriptive recall rather than applied understanding. Nalini et al. reported similar findings, where first-year learners scored higher in descriptive MCQs but had difficulty engaging with clinical vignettes that required interpretive reasoning [15]. Likewise, a Bangladeshi study by Amin et al. demonstrated that although undergraduate students retained factual aspects of anatomy and histology reasonably well, their ability to apply structural knowledge to functional or clinical contexts was substantially weaker [16]. This pattern suggests that current teaching practices prioritize memorization over deeper conceptual integration.

In the current study, second-year students did not perform significantly better than first-year students in answering clinically oriented MCQs. This indicates that additional exposure to anatomy courses in the second year did not markedly improve the ability to interpret applied anatomical concepts. A similar finding was reported by McHanwell *et al.*, who noted that even with curriculum advancement, students often fail to

transfer pre-clinical learning into clinically meaningful understanding without deliberate pedagogical linkage [17]. It underscores the need for structured integration of clinical relevance during early anatomy instruction, rather than postponing applied teaching to later phases.

Interestingly, the non-clinical groups of both years performed better overall than the clinical groups. One possible explanation is that the cognitive load involved in interpreting clinical MCQs—often containing complex case contexts—requires higher-order reasoning skills that students have not yet sufficiently developed. As suggested by Pandey and Zimitat, the ability to visualize and contextualize anatomical structures is acquired progressively through active learning and exposure to clinical cases [18]. Without continuous reinforcement of applied anatomy through case-based discussions or problem-based learning, students tend to revert to rote learning strategies that favor non-clinical factual questions.

Another notable finding was the slight decline in non-clinical performance among second-year students compared with first-year students. This observation may reflect cognitive overload due to increased curriculum demands in the second year, where new subjects like physiology and biochemistry require greater attention. Similar trends have been documented by Estai and Bunt, who noted that retention of basic anatomy diminishes over time unless reinforced through clinically contextual practice [19]. The absence of continuous clinical correlation throughout the pre-clinical years may therefore contribute to declining retention and application ability.

The lack of significant difference between first- and second-year clinical groups also suggests that clinical reasoning in anatomy does not automatically improve with progression through the curriculum. It may require explicit instructional design interventions such as case-based learning, radiologic anatomy sessions, or simulation-based modules to strengthen applied understanding. Studies from other regions, including Drake et al. and Turney, emphasize that linking anatomy teaching with clinical scenarios from the first year enhances students' motivation and comprehension of relevance [2,20]. Without such contextual reinforcement, students' engagement with anatomy remains superficial.

Moreover, the high number of incorrect responses among clinical groups in this study may also be attributed to limited opportunities for applied learning during the pre-clinical phase. Amin et al. reported that although Bangladeshi medical students retained factual information reasonably well, their understanding and application of basic science knowledge were markedly weaker, reflecting insufficient integration between foundational and clinical teaching [16]. This lack of structured clinical correlation at early stages prevents students from perceiving anatomy as an active component of patient care. The results of the present study, therefore, reinforce the need for stronger interdisciplinary collaboration and earlier clinical contextualization in anatomy teaching.

The findings of this study collectively suggest that while Bangladeshi medical students possess satisfactory factual anatomical knowledge, their ability to apply it in clinical contexts remains underdeveloped. Introducing clinically contextualized assessments, bedside demonstrations, and interdisciplinary teaching sessions may strengthen this linkage.

Limitations of the study

This study was conducted in a single government medical college, which may limit the generalizability of the findings to all medical institutions in Bangladesh. The MCQ sets, though validated, covered a limited range of topics and may not represent the full spectrum of regional anatomy. Students' prior exposure to similar question types and their test-taking motivation could also have influenced the results. Additionally, the study focused only on cognitive performance without evaluating long-term retention or clinical application in practice.

CONCLUSION

Undergraduate medical students demonstrated better performance in non-clinical anatomy MCQs than in clinically oriented ones, indicating difficulty in applying anatomical knowledge to clinical situations. Progression from first to second year did not significantly improve this ability. The findings highlight the need for stronger integration of clinical relevance into anatomy teaching from the early stages of medical education. Incorporating case-based learning, radiologic correlation, and interdisciplinary teaching may enhance students' clinical reasoning and prepare them more effectively for future medical practice.

Acknowledgment

I would like to express my sincere gratitude for the invaluable support and cooperation provided by the staff, participants, and my co-authors/colleagues who contributed to this study.

Conflicts of interest

There are no conflicts of interest.

Ethical approval

The study was approved by the Institutional Ethics Committee.

REFERENCES

1. Manara A, Uddin MN, Habib MA, Ayub M. Reflection of SAQ in Undergraduate Anatomy MBBS Course According to New Curriculum of

BMDC. Journal of Armed Forces Medical College, Bangladesh. 2012;8(2):3-7.
2. Drake RL, McBride JM, Lachman N, Pawlina W. Medical education in the anatomical sciences: The winds of change continue to blow. Anatomical sciences education. 2009 Nov;2(6):253-9.
3. Bakhshi SK, Afzal N, Merchant AA, Rahim KA, Shaikh NQ, Noorali AA, Lakhdir MP, Tariq M, Haider AH. Undergraduate medical education curriculum reforms in Pakistan: a mixed methods study of academic leadership perspectives. Academic Medicine. 2024 Jul 1;99(7):794-800.
4. Washburn S, Herman J, Stewart R. Evaluation of performance and perceptions of electronic vs. paper multiple-choice exams. Advances in physiology education. 2017 Dec 1;41(4):548-55.
5. Teli C, Kate N. Item analysis of multiple-choice questions in anatomy for first year MBBS. National Journal of Physiology, Pharmacy and Pharmacology. 2022;12(10):1529-32.
6. Khatun M. Analyses of medical undergraduate written questions and undergraduates' ability to answer clinically-oriented questions compared to non-clinically-oriented questions in Regional Anatomy (Doctoral dissertation, master's thesis, Bangabandhu Sheikh Mujib Medical University).
7. Miller SA, Perrotti W, Silverthorn DU, Dalley AF, Rarey KE. From college to clinic: reasoning over memorization is key for understanding anatomy. The Anatomical Record: An Official Publication of the American Association of Anatomists. 2002 Apr 15;269(2):69-80.
8. "Clinical anatomy" [Internet]. Vocabulary.com; [cited 2025 Nov 15]. Available from: https://www.vocabulary.com/dictionary/clinical%20anatomy
9. Pais D, Moxham BJ. Should gross anatomy be taught systemically or regionally. Eur J Anat. 2013;17(1):43-7.
10. Wineski LE. Snell's clinical anatomy by regions. Lippincott Williams & Wilkins; 2024 Jan 2.
11. Haque M, Yousuf R, Baker SA, Salam A. Assessment in undergraduate medical education: Bangladesh perspectives. Bangladesh Journal of Medical Science. 2013 Oct 26;12(4):357-63.
12. Baig M, Ali SK, Ali S, Huda N. Evaluation of multiple choice and short essay question items in basic medical sciences. Pakistan journal of medical sciences. 2014 Jan;30(1):3.
13. Akter M. Analyses of undergraduate written questions and medical undergraduates' ability to answer illustration-based and clinically oriented questions in neuroanatomy compared to non-illustration-based and non-clinically oriented questions (Doctoral dissertation, Thesis (MPhil). Bangabandhu Sheikh Mujib Medical University).
14. Chowdhury DK, Saha D, Talukder MH, Habib MA, Islam AS, Ahmad MR, Hossin MI. Evaluation of pharmacology written question papers of MBBS professional examinations. Bangladesh Journal of Medical Education. 2017 Jul 26;8(2):12-7.
15. Nalini YC, Manivasakan S, Pai DR. Comparison between MCQ, Extended matching questions (EMQ) and Script concordance test (SCT) for assessment among first-year medical students–A pilot study. Journal of Education and Health Promotion. 2024 Feb 1;13(1):52.
16. Amin NF, Akter M, Kabir MH, Shamim KM. Medical undergraduates' residual knowledge of structural, functional and clinical aspects of cell and histology at recall and understanding levels. Bangladesh Journal of Anatomy. 2013;11(1):34-43.
17. McHanwell S, Davies DC, Morris J, Parkin I, Whiten S, Atkinson M, Dyball R, Ockleford C, Standring S, Wilton J. A core syllabus in anatomy for medical students-Adding common sense to need to know. European Journal of Anatomy. 2021 Apr 14;11(S1):3-18.
18. Pandey P, Zimitat C. Medical students' learning of anatomy: memorisation, understanding and visualisation. Medical education. 2007 Jan;41(1):7-14.
19. Estai M, Bunt S. Best teaching practices in anatomy education: A critical review. Annals of Anatomy-Anatomischer Anzeiger. 2016 Nov 1; 208:151-7.
20. Turney BW. Anatomy in a modern medical curriculum. The Annals of The Royal College of Surgeons of England. 2007 Mar;89(2):104-7.