

Perceptions of Anatomy Education among Radiological Techniques Students in Iraq: A Cross-Sectional Study

Zaid Saad Madhi ^{1,*}, Mohannad Ali Hasan ², Alaa A. Hussein Al-Algawy ², Saad Abed Madhi ³

¹ Department of Internal Medicine, College of Medicine, Al-Mustaqbal University, Hillah 51001, Babylon, Iraq.

² Department of Surgery, College of Medicine, University of Babylon, Hillah 51002, Babylon, Iraq.

³ Radiological Techniques Department, Health and Medical Techniques College, Al-Mustaqbal University, Hillah 51001, Babylon, Iraq.

* Corresponding author: zaid.saad@uomus.edu.iq

Submission: January 12, 2026 Accepted: March 2, 2026 Published: March 31, 2026

Abstract

Background: Anatomy is a cornerstone in medical education for all medical and healthcare specialties. It provides students with the foundational knowledge needed to build concepts for understanding clinical scenarios, identifying anatomical abnormalities, and delivering safe clinical practice. **Objectives:** The objectives of this study are to identify factors influencing student satisfaction with anatomy education and their association with academic performance among radiological techniques students in Iraq. **Materials and Methods:** This is a cross-sectional study of 421 radiological techniques students across all academic years conducted in Babylon, Iraq. A locally developed, validated questionnaire was used to assess perceptions of anatomy education. **Results:** Student satisfaction was significantly associated with lecture quality ($\chi^2 = 166.69$, $p < 0.001$), lecturer performance ($\chi^2 = 168.12$, $p < 0.001$), practical laboratory experience ($\chi^2 = 65.90$, $p < 0.001$), technology integration ($\chi^2 = 37.10$, $p < 0.001$), and clinical relevance ($\chi^2 = 158.37$, $p < 0.001$). Similarly, examination performance was significantly associated with lecturer performance ($\chi^2 = 58.77$, $p < 0.001$), lecture quality ($\chi^2 = 80.53$, $p < 0.001$), practical labs ($\chi^2 = 65.90$, $p < 0.001$), technology integration ($\chi^2 = 37.10$, $p < 0.001$), and clinical relevance ($\chi^2 = 18.67$, $p < 0.001$). **Conclusion:** Student satisfaction with anatomy education among radiological techniques students in Iraq is most determined by the performance of the lecturers and the quality of their lectures, followed by the availability of hands-on practical laboratory experiences. These factors are essential in developing confident clinical staff and promoting healthcare

Keyword: Medical education, Satisfaction, Radiology techniques, Iraq

Introduction

Anatomy is a cornerstone in medical education for all medical and healthcare specialties. It provides students with the foundational knowledge needed to build concepts for understanding clinical scenarios, identifying anatomical abnormalities, and delivering safe clinical practice [1,2]. Specifically for radiological disciplines, Anatomy highlights the

need to provide safe and effective patient care and build the basic knowledge for normal and pathological findings [3,4]. In Iraq, specific systemic issues may affect the quality of anatomy education, such as the prolonged war, financial issues, and political instability, which might all play an important role in leading to a decline in the quality of faculty with declining qualifications [5]. Al-Shamsi (2017) [6] notes

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that the conflicts in 1991, which continued for 10 years, limited access to updated textbooks and led to a decline in the number of students studying internationally. Furthermore, after 2003, there was a departure of qualified academics, which led to an apparent defect in the qualified faculties [7]. The most critical decline was in practical anatomy, specifically the unavailability of cadaveric dissection, which is an essential method for learning anatomy [8]. While many research studies have been conducted on anatomy training for medical and dental students, other allied health students, particularly those enrolled in technical programs such as Radiology techniques, are understudied. [9]. Radiology students must have a particular anatomical foundation that includes not only a comprehension of gross structures but also the ability to correlate these with CT, MRI, and ultrasound data in real-time. [3] [10]. The coursework they receive must include imaging technologies and basic science; nevertheless, the vast majority of past research generally combines all these areas of study or prioritizes students on the medical track. [11]. Despite advances in technology, including 3D imaging, Anatomy simulation tables, and VR, funding limitations have been demonstrated, and these educational resources in Iraqi institutions remain limited. [7]. Traditional methods of instruction continue to be in place, but students are increasingly asking for technologically enhanced and clinically integrated learning environments. The disparity between the materials available and the demands of students may lead to discouragement, disappointment, and ultimately, deficits in clinical competence. [12] To the best of our knowledge, no study evaluates anatomy education from the perspective of allied health students in Iraq. Limited evidence exists regarding perceptions of anatomy education among allied health students, particularly

radiological techniques students, in conflict-affected settings such as Iraq. Evaluating students' perceptions regarding their education is crucial for obtaining the best clinical training. The objectives of this study are to identify factors influencing student satisfaction with anatomy education and their association with academic performance among radiological techniques students in Iraq. This study aims to enhance the quality of clinical-related education by highlighting the perspectives of allied health students. Our research questions: What factors most strongly influence radiological techniques students' satisfaction with anatomy education? How do these factors correlate with students' examination performance? And finally, do the academic stages or gender moderate these relationships?

Materials and Methods

This is a cross-sectional study conducted at the Health and Medical Techniques College, Al-Mustaqbal University, Babylon, Iraq. This study has been conducted on the Radiological Techniques Department of all four levels. All eligible students (N=450) enrolled in the Radiological Techniques department who had completed ≥ 1 anatomy course. The response rate was 93.6% (421/450), with non-respondents primarily absent during data collection periods. The students in this department study general anatomy in the first level, and radiological anatomy in the second and third levels. Finally, the study involved 421 students. The study was conducted using a structured questionnaire in Google Forms, and the link was distributed through the students' groups. The Inclusion Criteria were limited to students who enrolled in the Radiological Techniques program at the college and had completed a minimum of one anatomy course. We developed a structured

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questionnaire comprising five core domains of anatomy education: lecture quality, lecturer performance, practical experience, technology integration, and clinical relevance. The structured questionnaire domains have been measured dependent on multiple items on the 5-point Likert scale, in which 1 is strongly disagree, while 5 represents a strong agreement. The final results are 25 items. These items were chosen based on academic staff opinions, literature and students' feedback. To test the validity and reliability of the items, 5 experts, including 2 anatomy lecturers, a radiologist, and a medical education researcher, evaluated the content. If the item's content validity is less than 0.70, the item has been changed or neglected. The scale's content validity index was 0.78. A pilot study of 30 students has been conducted to test reliability. Internal consistency was calculated, and finally, the Test retest revealed an interclass correlation coefficient of 0.84, which refers to a good stability index.

Ethical Considerations

Ethical approval has been obtained from the Medical Research Bioethical Committee at the University of Al Mustaqbal, registration number med2 11.10.24.

Statistical analysis

The data of this study were analyzed using the Statistical Package for the Social Sciences (SPSS 24.0). The descriptive statistics were expressed in terms of frequency and percentage for qualitative variables, in appropriate tables and graphs. Correlation among variables has been calculated using Chi-square tests. To assess associations, a p-value < 0.05 is considered significant.

Results

This is a cross-sectional study that involved 421 students in the radiological techniques department. In this study, female students were the majority, nearly 58%. The sample size was sufficient for meaningful statistical power (Table 1-3).

Table 1: Baseline Characteristics of Study Participants

Baseline data (N=421)	Total No. (%)
Stage	
First	36 (9)
Second	202 (48)
Third	125 (30)
Fourth	58 (14)
Gender	
Female	245 (58)
Male	176 (42)
Study length (No of Anatomy courses)	
One Course	97 (23)
Two Courses	205(49)
<Three Courses	119 (28)
Satisfaction	
Median:	3
1 (Very dissatisfied)	58(14)
2	61(15)
3	158(38)
4	76(18)
5 (Very satisfied)	68(16)
Exam scores	
1 Weak	21(5)
2 Fair	37(9)
3 Average	166(39)
4 Good	111(26)
5 Very good	86(20)

Table 2: The Five-Item Domain baseline characteristics

Variable	Male Mean ± SD	Female Mean ± SD	p-value	Effect Size (r)
Satisfaction	3.13 ± 1.18	3.05 ± 1.27	0.568	0.028
Exam Grade	2.81 ± 0.86	2.78 ± 0.89	0.990	0.001
Lecture Quality	2.88 ± 1.30	2.79 ± 1.17	0.520	0.031
Lecturer Performance	2.94 ± 1.31	2.75 ± 1.23	0.188	0.064
Exam Difficulty	3.36 ± 1.04	3.58 ± 1.07	0.029	0.106

Table 3: Stage Differences in Key Variables.

Variable	Stage 1	Stage 2	Stage 3	Stage 4	H-statistic	p-value
Satisfaction	3.17 ± 1.08	3.05 ± 1.31	3.02 ± 1.19	3.28 ± 1.14	1.36	0.714
Exam Grade	2.83 ± 1.21	2.50 ± 0.75	3.06 ± 0.83	3.22 ± 0.80	55.45	<0.001
Lecture Quality	3.17 ± 1.28	2.67 ± 1.22	2.73 ± 1.15	3.38 ± 1.18	17.49	0.001
Lecturer Performance	3.19 ± 1.35	2.73 ± 1.31	2.66 ± 1.18	3.33 ± 1.13	15.82	0.001
Exam Difficulty	3.36 ± 1.20	3.77 ± 0.97	3.12 ± 1.09	3.34 ± 0.98	30.04	<0.001

Students' satisfaction and Anatomy education

A series of chi-square tests of independence examined the relationship between overall satisfaction (5-point Likert) and ratings of five educational domains. All five domains showed statistically significant associations with satisfaction: Lecture Quality: $\chi^2(16) = 166.69$, $p < 0.001$, Lecturer Performance: $\chi^2(16) = 168.12$, $p < 0.001$, Practical Laboratory Experience: $\chi^2(8) = 65.90$, $p < 0.001$, Technology Integration: $\chi^2(8) = 37.10$, $p < 0.001$ and Clinical Relevance: $\chi^2(16) = 158.37$, $p < 0.001$. Approximately 39% of students reported that anatomy lab resources were sufficient; in contrast, approximately 61% reported insufficient anatomy lab resources. These results show that how people feel about the quality of teaching, the design of the curriculum, and the relevance of what they learn

in real life are all critical factors in their satisfaction with anatomy education (Figure 1).



Figure 1: Line chart showing the relationship of Anatomy-related quality metrics versus the Satisfaction of Anatomy Education

Students' examination scores and Anatomy education

Chi-square tests were also conducted to evaluate associations between self-reported examination grades and the same five educational domains. All domains were significantly associated with exam performance: Lecture Quality: $\chi^2(16) = 80.53$, $p < 0.001$, Lecturer Performance: $\chi^2(16) = 58.77$, $p < 0.001$, Practical Laboratory Experience: $\chi^2(8) = 65.90$, $p < 0.001$, Technology Integration: $\chi^2(8) = 37.10$, $p < 0.001$ and Clinical Relevance: $\chi^2(16) = 18.67$, $p < 0.001$. These results show that how well students do in anatomy is closely related to how they feel about the quality of the instruction, the use of resources, hands-on learning, and the relevance of the curriculum. Table (3)

Academic stage and gender in association with students' satisfaction and exam scores

We used chi-square tests of independence to examine the relationships between variables, exam grades and satisfaction with anatomy education (N = 421). There was a strong link between academic stage and exam grades ($p <$

0.001). In the academic stage and satisfaction levels, there was no significant difference. This means that how well students perform in school affects how they feel about the course and their test results. Students' gender revealed no significant effect on exam grades or even satisfaction levels ($p > 0.05$).

Multivariate Analyses

Multiple linear regression ($R^2 = 0.254$, Adjusted $R^2 = 0.247$) confirmed lecturer performance as the strongest independent predictor of satisfaction ($\beta = 0.419$), followed by laboratory sufficiency ($\beta = 0.162$) and lecture quality ($\beta = 0.157$).

Discussion

The study demonstrated the perception of radiological techniques students in Babylon, Iraq. Students' satisfaction is determined by the quality of the lectures, lecturer performance and the practical labs equipment. The study also evaluated the significance of gender and level of academic stages in relation to satisfaction. These results align with other research which evaluated anatomy education for healthcare students [13]. In our study, the majority of students had reported the inadequacy of practical anatomy labs, which indicated a strong predictor of dissatisfaction ($\chi^2 = 43.10$, $p < 0.001$). This result is the same as other research studies, which demonstrated that cadaveric dissection remains the best method for anatomy education, even with the development of advanced technology [8,14]. This indicated that a radiological technique is hand on training in its nature, a lack of such practical training affects the education quality and preparation for postgraduate jobs. However, in Iraq, as in many other parts of the world, practical anatomy education is often implemented through modules and modern technology, and is independent of

dissection [5,6]. This is considered a crucial issue that warrants reevaluation. Moglia et al. (2024) warned that a poor understanding of anatomy can lead to increased harm from malpractice and compromise patient safety [4]. The most significant factor associated with student satisfaction was lecturer performance ($\chi^2(16) = 168.12$, $p < 0.001$). In contrast, while still significant, the association between lecturer performance and examination scores was comparatively weaker ($\chi^2(16) = 58.77$, $p < 0.001$), suggesting that teaching excellence influences student perception more strongly than it directly predicts graded performance in this cohort. Our findings support Berman et al. (2015), who identified four hallmarks of effective teaching: in-depth subject knowledge, the ability to create a safe and collaborative learning environment, the capacity to ask meaningful, practical questions, and the provision of timely and specific feedback [15]. In Iraq, where curricula are heavily dependent on lecturers [6]. Having a dynamic lecturer who is focused on the students may have a significant impact. Students in our study probably saw high-performing teachers as rare sources of clarity, support, and clinical relevance in an otherwise disorganised school setting. This finding is similar to the results of Sbayeh et al. (2016), who also evaluated the importance of teaching that connects basic science to clinical practice. This is important for radiological techniques students who need to apply their knowledge of anatomy to image interpretation [11]. In our study, the quality of lectures showed a significant association with satisfaction ($\chi^2 = 166.69$, $p < 0.001$). Rehman et al. (2025) [3] reported that anatomy education must be more associated with clinical situations to demonstrate the importance of anatomical education. This involves correlating radiological anatomy with the use of all radiological modalities, such as

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MRI, CT, and ultrasound, in lectures and practical sessions. Such a correlation would enhance students' understanding and information retention [10]. Radiological students in more advanced academic stages reported higher satisfaction and achieved better exam grades. This suggests that cumulative exposure to anatomy content and clinically relevant scenarios may develop confidence and improve academic performance over time [14]. Although Iraqi universities may have limited digital infrastructure and access to advanced anatomical tools, 67.5% of students reported high satisfaction with technology integration. There are two different perspectives to consider in understanding this conflict. Firstly, students may express aspirational contentment with technology, even if they don't use it frequently. Second, even using small quantities of technology, such as using lecture presentations with PowerPoint with radiological imaging, demonstrating dissection videos, or using a mobile anatomy application, might have significant effects on students' understanding of Anatomy. In places with few resources, even minor improvements in technology can seem like big wins, which is why students give them such high scores [16,17].

Limitations

We admit several limitations of this study one its single-institution, cross-sectional study, which preclude the causal and generalizability to other settings. A self-reported questionnaire might be subjected to potential bias.

Conclusion

Student satisfaction with anatomy education among radiological techniques students in Iraq is most determined by the performance of the lecturers and the quality of their lectures, followed by the availability of hands-on practical

laboratory experiences. These factors are essential in developing confident clinical staff and promoting healthcare.

Acknowledgements: Students of Al-Mustaqbal University, College of Medical and Health Techniques for their participation in the study

AI Disclosure Statement: Grammarly was used for grammar and language editing assistance.

Availability of data and material: On Request

Competing interests: The Authors declare no conflict of interest

Funding: No Funding received.

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