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Impact of Virtual Dissection Table (Anatomage) Versus Traditional Methods in Teaching Imaging and Radiology: A Comparative Study Among Respiratory Care Students in CAMSJ

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Abstract

Imaging and radiology education is a core component of the Respiratory Care curriculum, as it supports students' understanding of anatomical structures and the interpretation of diagnostic imaging modalities such as CT and MRI. Traditional teaching methods often depend on static, two-dimensional images from textbooks or clinical settings, which may limit students' ability to visualize complex three-dimensional anatomical relationships and negatively affect knowledge retention and clinical application. Recent advances in educational technology have introduced tools such as the Anatomage Virtual Dissection Table, which provides interactive, three-dimensional visualization of real human anatomy derived from CT and MRI data. This study aims to assess the impact of integrating the Anatomage Virtual Dissection Table on Respiratory Care students' learning, including short- and long-term memorization, academic performance, and learning preferences, in the Imaging and Radiology course at the College of Applied Medical Sciences, Jubail, Imam Abdulrahman bin Faisal University (IAU), Saudi Arabia. A comparative, questionnaire-based study was conducted among 46 second-year female Respiratory Care students with no prior experience in imaging and radiology. Participants were randomly assigned to either a traditional teaching group (n = 23) or a traditional teaching group integrated with the Anatomage Virtual Dissection Table (n = 23). A pretest was administered to assess baseline knowledge before instruction on segmental chest anatomy using CT images. Learning outcomes were evaluated immediately after the lecture and one week later to assess short- and long-term knowledge retention. Student perceptions and learning preferences were collected using a structured questionnaire. The statistical analysis of the study demonstrated a significant improvement in the academic performance of students who utilized the Anatomage Table compared to those taught through traditional methods. In the immediate post-test which assess the short-term retention of the students, the experimental group achieved substantially higher scores across all five evaluated domains, including chest anatomy and radiological interpretation. Furthermore, the long-term retention test confirmed that these students maintained a deeper understanding of the material over time, proving that the 3D interactive visualization effectively bridges the gap between theoretical knowledge and clinical imaging. In conclusion, the integration of the Anatomage Virtual Dissection Table serves as a transformative tool in respiratory care education. By providing a realistic and interactive learning environment, it significantly enhances both short-term comprehension and long-term memory retention. The study strongly recommends that educational institutions adopt a blended learning model that combines traditional lectures with advanced virtual technology. This approach not only improves student engagement but also ensures a higher level of competency in interpreting complex radiological data, which is essential for future clinical practice.

Keywords: *Anatomage; Radiology; Quality Education*

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Introduction

Traditional anatomy education has predominantly depended on lectures, textbooks, and two-dimensional illustrations; however, such methods often offer inadequate spatial visualization of anatomical structures. Consequently, healthcare students may encounter challenges in comprehending three-dimensional anatomical relationships and integrating anatomical knowledge with radiological imaging (Triepels et al., 2020).

In imaging and radiology education, the challenge is further compounded by the need to interpret cross-sectional images obtained from computed tomography (CT) and magnetic resonance imaging (MRI). Students, particularly in the early stages of their training, often experience difficulty visualizing anatomical structures across different imaging planes, which can negatively influence learning outcomes, motivation, and long-term knowledge retention (Ruisoto et al., 2012). To address these educational challenges, technology-enhanced learning tools have been increasingly integrated into healthcare education. One notable innovation is the Virtual Dissection Table (Anatomage), which enables learners to explore high-resolution, life-sized, three-dimensional anatomical models reconstructed from real human CT and MRI datasets. This technology allows interactive manipulation of anatomical structures and supports direct correlation between anatomical concepts and radiological imaging, thereby fostering active and self-directed learning (Moro et al., 2017).

Accordingly, this study aims to evaluate the effectiveness of integrating the Anatomage Virtual Dissection Table into imaging and radiology education for Respiratory Care students at the College of Applied Medical Sciences in Jubail, Imam Abdulrahman Bin Faisal University (IAU), Saudi Arabia. The study specifically emphasizes students' understanding, memorization, and overall learning outcomes. Despite the expanding literature supporting the educational benefits of virtual anatomy technologies, there remains a scarcity of research conducted in Saudi Arabia examining the effectiveness of virtual dissection technologies in imaging and radiology education (Al-Khalifa & Al-Mohaimeed, 2019). Moreover, most of the previous studies have predominantly focused on medical students, with comparatively limited attention given to other healthcare disciplines, including Respiratory Care, where strong anatomical knowledge and radiological image interpretation skills are essential (Drake et al., 2009 and Radić et al., 2022).

The Anatomage Virtual Dissection Table was released in 2016 at www.Anatomage.com, and it is defined as an innovative educational tool that provides a life-sized, three-dimensional visualization of real human anatomy using high-resolution CT and MRI data. It allows students to interactively explore anatomical structures through rotation, zooming, and virtual dissection, which enhances spatial understanding and supports deeper comprehension of complex anatomical relationships. The use of the Anatomage Table has been shown to improve student engagement and learning satisfaction, particularly when used as a complementary tool alongside traditional cadaver-based instruction in medical education (Fyfe et al., 2013 and Alasmari, 2021).

Another application of the Anatomage is the radiological imaging correlation which integrates cross-sectional anatomy with corresponding clinical imaging, such as CT and MRI scans. This enables students to correlate anatomical structures with clinical findings and improves their ability to interpret medical images. Studies have shown that incorporating radiology into anatomy teaching enhances students' understanding of spatial relationship s between structures and supports clinical application of anatomical knowledge (D'Souza, et al., 2014). This can be integrated with self-directed learning or clinical radio logy cases, allowing students to explore pathology and the clinical relevance of anatomical structures. This approach enhances clinical reasoning and supports the application of anatomical and radiological knowledge in real healthcare settings (Darras, 2019 and Elsayed, 2025).

Imaging and radiology education represents a fundamental component of Respiratory Care programs, as it equips students with the essential knowledge required to interpret diagnostic imaging modalities such as computed tomography (CT) and magnetic resonance imaging (MRI). A solid understanding of human anatomy is crucial for accurate image interpretation and sound clinical decision-making. However, students often struggle to correlate two-dimensional radiological images with three-dimensional anatomical structures when traditional teaching methods are used alone. Consequently, there is an increasing need for innovative instructional strategies that enhance students' comprehension, spatial understanding, and long-term retention of imaging-related anatomical concepts (Turney, 2007; Azer & Eizenberg, 2007).

Brown et al. (2015) and Paech et al. (2017) demonstrated that virtual dissection tools such as the Anatomage Virtual Dissection Table significantly enhance students' anatomical knowledge, spatial visualization skills, and engagement compared with traditional teaching methods. The integration of Anatomage into imaging and anatomy education addresses key limitations of conventional approaches by allowing students to interact with high-resolution three-dimensional anatomical models and manipulate structures in real time, thereby improving understanding of spatial relationships between organs and systems. Moreover, correlating 3D anatomical models with cross-sectional CT and MRI images supports deeper learning and leads to improved short- and long-term educational outcomes in imaging and radiology courses.

Fyfe et al. (2013) showed that virtual anatomy tools can significantly enhance students' spatial understanding, engagement, and academic performance compared with traditional teaching methods. They also demonstrated that virtual dissection platforms allow repeated exploration from multiple perspectives, which may contribute to improved memorization and long-term retention of anatomical knowledge.

The significance of this study lies in its potential to provide evidence-based insights into the effectiveness of integrating the Anatomage Virtual Dissection Table into imaging and radiology education for Respiratory Care students. The findings may contribute to curriculum development, inform modern teaching strategies, and support the adoption of innovative educational technologies aimed at improving learning outcomes. Advances in educational technology have created new opportunities for healthcare students to learn anatomy through interactive and immersive methods, which have been shown to enhance understanding of complex anatomical relationships and improve knowledge retention (Nicholson et al., 2006; Triepels et al., 2020).

Methodology

System Design

This study conducted a quasi-experimental design to evaluate the impact of integrating the Anatomage Virtual Dissection Table on students' learning in the Imaging and Radiology course, particularly in terms of understanding, memorization, and academic performance. The system aims to create an interactive learning environment that allows students to explore anatomical structures in three-dimensional form, facilitating a deeper comprehension of segmental chest anatomy in CT imaging.

Equipment Required

The Anatomage Table consists of a large, life-size touch-enabled display integrated with a high-performance computer system running specialized Anatomage software. It includes detailed 3D anatomical models based on real human cadavers and medical imaging data, along with interactive tools for virtual dissection, labeling, and visualization. The system also provides connectivity ports, audio support in some models, and built-in power and cooling components to ensure stable operation.

Figure 1. Anatomage Table in Anatomy Lab, CAMSJ

The present study was conducted using the Anatomage Table (Fig. 1) in Anatomy Lab, CAMSJ (Anatomage Inc., San Jose, California, USA), version TS001 Rev A (4 Nov 2016). The device is a life-size virtual dissection and 3-dimensional visualization system designed for interactive anatomical education. The Anatomage Table was installed and utilized in the Anatomy Laboratory of the College of Applied Medical Sciences (CAMSJ), where students interacted with digital cadaveric models to explore anatomical structures and radiological correlations in a controlled educational environment.

Experiment

This experimental study was carried out at the College of Applied Medical Sciences, Imam Abdulrahman Bin Faisal University (IAU), Jubail, Kingdom of Saudi Arabia. The participants were second-year female students enrolled in the Respiratory Care Technology program. All participants had successfully completed their first academic year and had no previous background in imaging, radiology, or advanced anatomy instruction.

Students were invited to participate through official university communication and in-person announcements. Written informed consent was obtained from all participants prior to enrollment. Participation was voluntary, and the study activities were completed within a maximum duration of six months.

The required sample size was calculated using the Raosoft sample size calculator with a 95% confidence level and a 5% margin of error. As shown in Fig (2), a total of 30 students participated and completed a pretest to evaluate baseline knowledge of chest segmental anatomy. Following this, participants were randomly assigned to one of two instructional groups.

- **The first group** received conventional classroom-based teaching on CT chest segmental anatomy.
- **The second group** was taught using the same traditional lecture supplemented with hands-on learning through the Anatomage Table, a digital human anatomy visualization system.

In both groups, five Learning domains (Table-1) were assessed using knowledge tests administered immediately after the instructional session to evaluate short-term memory retention, and again one week later to measure long-term knowledge retention. After completing all assessments, students in the traditional lecture group were also given the opportunity to experience learning with the Anatomage Table to ensure educational equity.

The following link outlines the key educational questions and learning objectives used in the pre-test and post-test to assess students' understanding of chest anatomy and CT image interpretation during the two types of learning sessions.

Link:
https://drive.google.com/file/d/1rNG3jSsdEAg3bj9Z_U6JTxWikim7tmxR/view?usp=drivesdk

At the end of the study, participants completed a structured questionnaire designed to collect feedback regarding their learning experience, perceptions, and preferences related to the use of the Anatomage Table compared with traditional teaching methods in imaging and radiology education.

Link:
https://docs.google.com/forms/d/e/1FAIpQLSfHwDcMpZ1ReZWe7rv6peOmgxKRc4UsbiAFX91lLmpDTFa2xA/viewform

Domain	Description	Focus
1	Orientation	Understanding anatomical planes and directional terminology on a CT slice
2	Lobar Anatomy	Identification of lung lobes and fissures
3	Bronchial Pathway	Tracing the airway tree from trachea to segmental bronchi
4	Positioning	Impact of patient position (supine/prone) on image appearance and gravity-dependent density
5	CT Navigation	Windowing, scrolling, and identifying scan parameters

Statistical Analysis

The collected data were statistically analyzed using IBM SPSS Statistics (Version 26.0, IBM Corp., Armonk, NY) to assess differences in learning outcomes and student perceptions between the traditional teaching group and the Anatomage-assisted teaching group (IBM Corp., 2019).

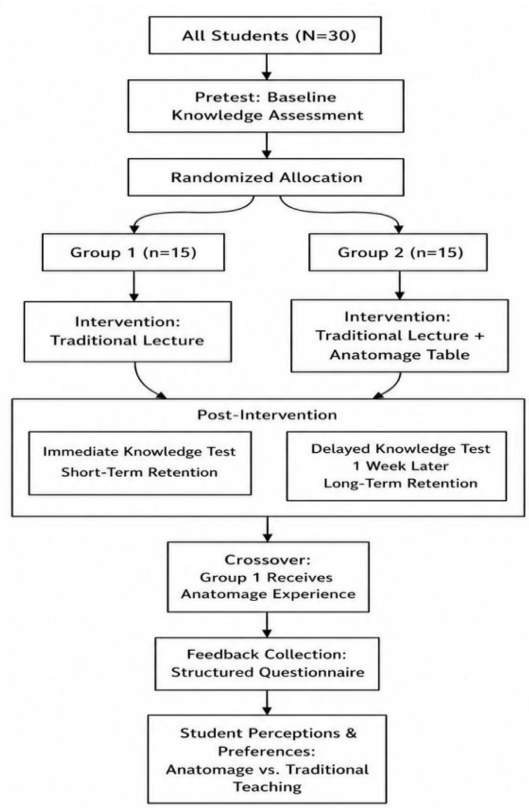

Fig 2. Methodology of the study

Results

Student Performance in Pre, Post and Midterm tests

In comparing the results of the multiple-choice questions administered after the study session, Wilcoxon Signed-Rank test was utilized to analyze the results of the learning outcomes of students in the control (Traditional) and experimental groups. Each two groups exhibited a statistically significant difference in the average number of correct answers (Table 2).

Nonparametric Tests

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.[a,b]	Decision
1	The median of differences between PreTest and PostTest equals 0.	Related-Samples Wilcoxon Signed Rank Test	.005	Reject the null hypothesis.

a. The significance level is .050.

b. Asymptotic significance is displayed.

Table (2): Nonparametric Hypothesis Test Summary for Pre-Test and Post-Test Scores

Full Statistical Result Table

Table (3): Wilcoxon Signed Rank Test Results for Paired Score Comparisons

Comparison Pair	Test Statistic (W)	Std. Error	P-Value (Sig.)	Is it Significant? (α=.05)	Final Decision
Pre-Test vs. Post-Traditional	65.500	15.855	.412	No	Retain Null
Pre-Test vs. Post-Anatomage	93.000	15.898	.011	**Yes**	Reject Null
Post-Anatomage vs. Post-Traditional	6.000	12.674	.009	**Yes**	Reject Null
Anat. Midterm vs. Trad. Midterm	**0.000**	**8.261**	.006	**Yes**	Reject Null
Anat. Midterm vs. Post-Anatomage	120.000	17.518	< .001	**Yes (Highly)**	Reject Null
Post-Traditional vs. Trad. Midterm	72.000	12.674	.009	**Yes**	Reject Null

According to Wilcoxon Signed Rank Test Results for Paired Score Comparisons (Table 3), the following comparisons could be reported:

Pre-Test vs. Post-Traditional:

The P-value (0.412) was much higher than the significance threshold of .05. This indicates that the traditional teaching method did not lead to a measurable or reliable improvement in scores from the beginning to the end of the study (Fig. 3). The observed differences are likely due to random chance.

Pre-Test vs. Post-Anatomage:

Because the P-value (.011) is below .05, this confirms that students using Anatomage method showed a real, statistically verifiable improvement in their scores compared to their starting baseline (Fig. 4).

Post-Traditional vs. Post-Anatomage:

This is a direct comparison of the two final outcomes. The significant P-value (.009) proves there was a meaningful difference between the two groups at the end of the study, suggesting that integration of the Anatomage beside the traditional method was more effective (Fig. 5).

Post-Traditional vs. Traditional Midterm:

While the traditional group did not show significance compared to their original pre-test, they did show a significant change between their midterm and final test (Fig. 6). This suggests that learning occurred in the latter half of the course, though it was not enough to create a significant total improvement from the very start of the study.

Post-Anatomage vs. Anatomage Midterm:

This result showed the strongest statistical evidence in the study. The P-value of less than .001 indicates that students who were taught using Anatomage showed highly significant improvement in their performance in the midterm exam (Fig. 7).

Anatomage Midterm vs. Traditional Midterm:

A test statistic of 0.000 is a strong indicator that the differences between these two groups were entirely uniform (one group consistently outscored the other). This shows that even by the midterm point, the choice of instructional method had already created a significant performance gap (Fig. 8).

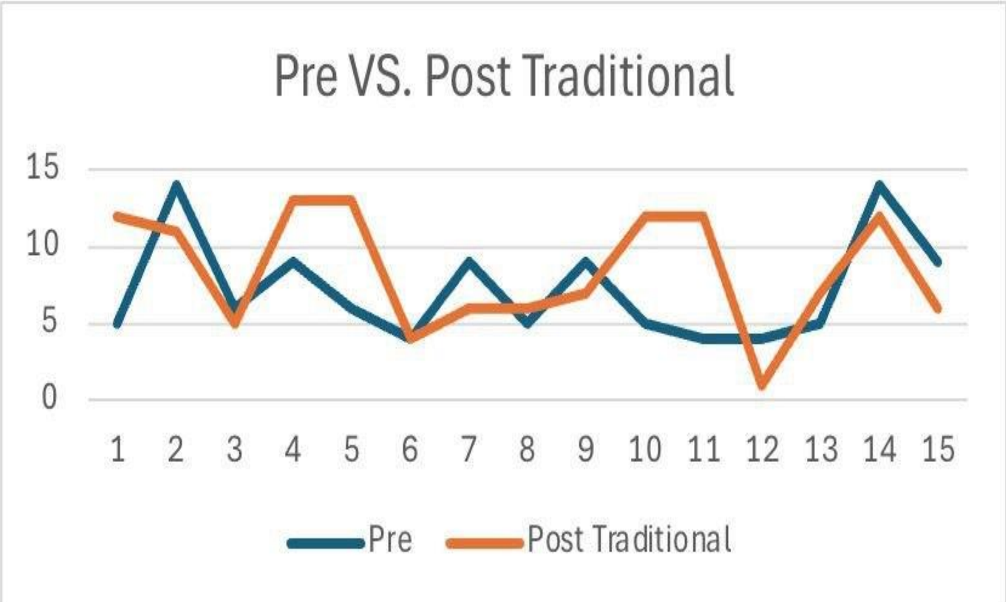

Figure 3.: Scores of students in theory tests for traditional group. Significant, $P < 0.05$ ($n = 15$).

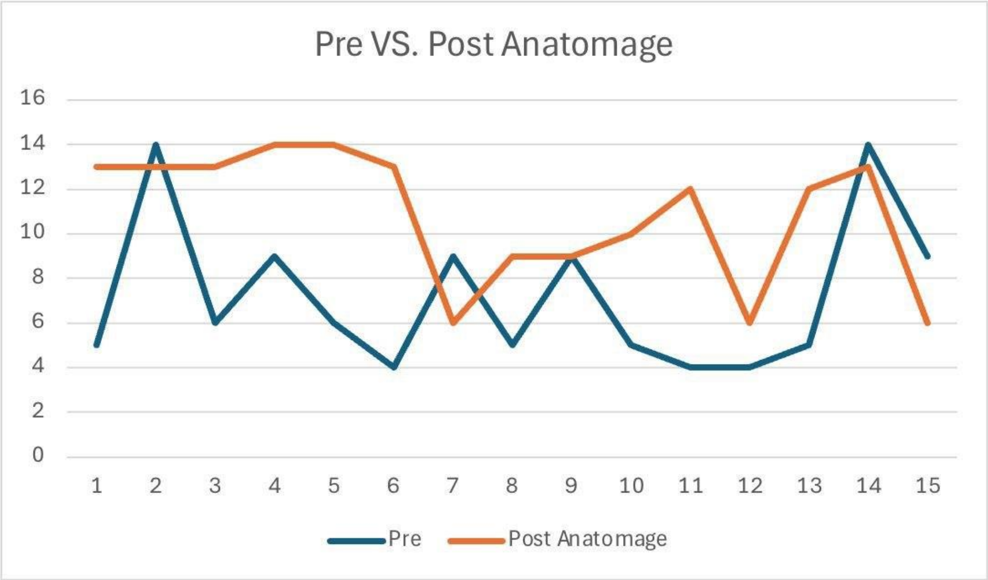

Figure 4.: Scores of students in Pre and Post theory tests for Anatomage group. Highly significant, $P < 0.001$ ($n = 15$).

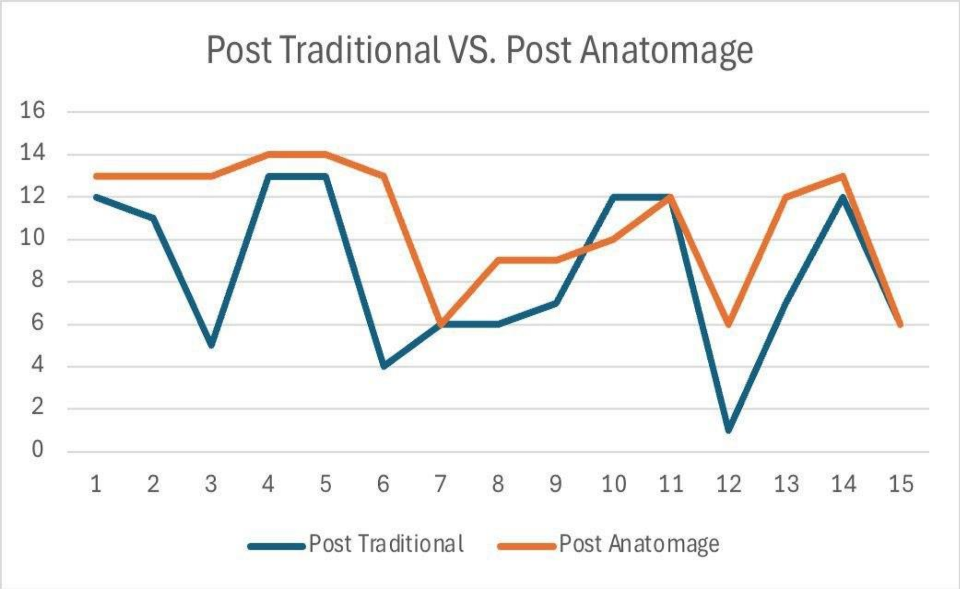

Figure 5.: Comparison of students' scores in Post-theory tests between Traditional and Anatomage groups. Highly significant, $P < 0.001$ ($n = 15$).

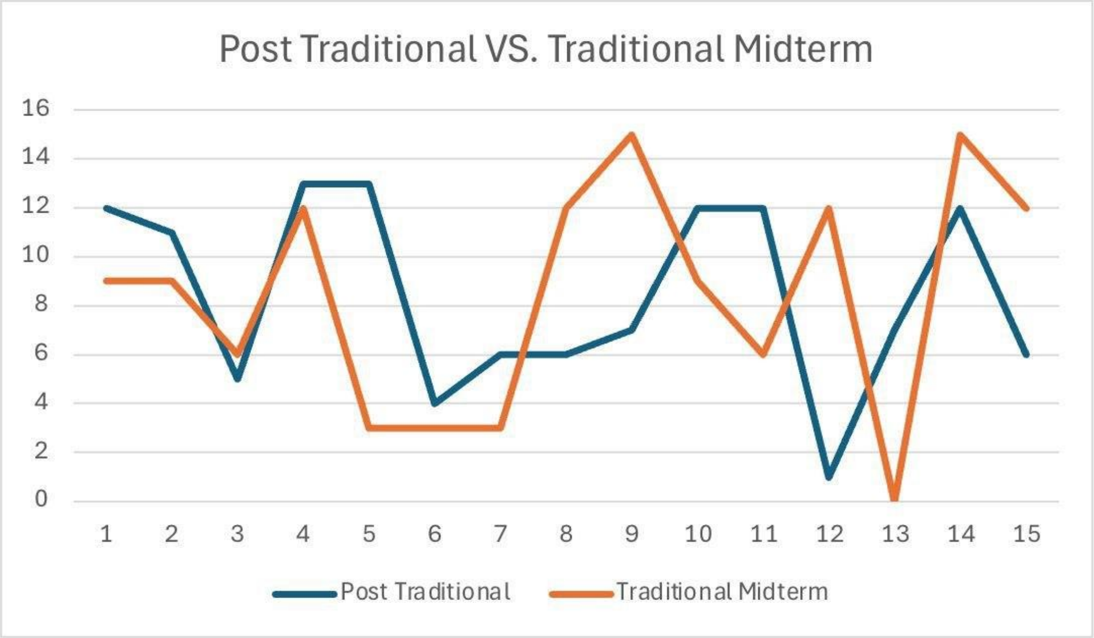

Figure 6.: Students' scores in theory tests: Comparison between Traditional Post-test and Midterm results. Significant, $P < 0.05$ ($n = 15$).

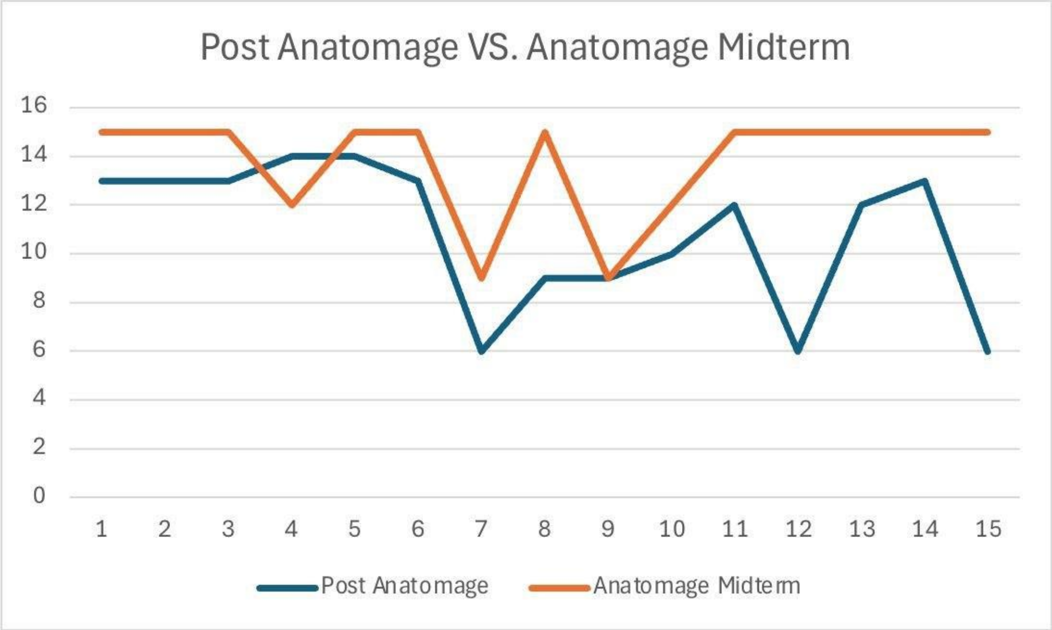

Figure 7.: Students' scores in theory tests: Comparison between Anatomage Post-test and Midterm results. Highly significant, $P < 0.001$ ($n = 15$).

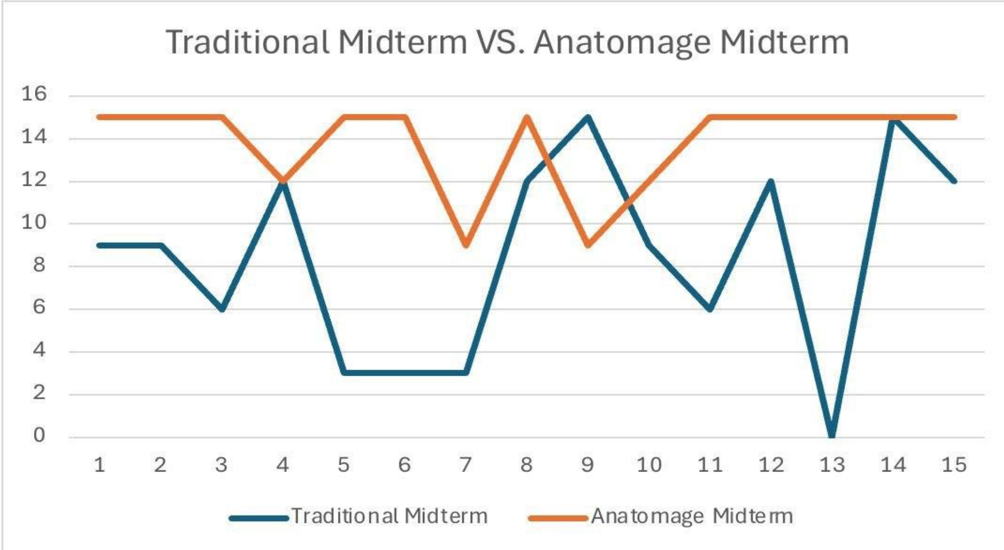

Figure 8.: Comparison of students' scores in theory midterm tests between Traditional and Anatomage groups. Highly significant, P < 0.001 (n = 15).

Domain (Pre-test vs. Post-test)	Significance (p-value)	Statistical Interpretation
Domain 1: Basic Understanding	0.010	Statistically Significant
Domain 2: Anatomical Structures	0.022	Statistically Significant
Domain 3: Complex Concepts	0.012	Statistically Significant
Domain 4: Advanced Topics	0.135	Not Significant
Domain 5: Overall Progress	0.014	Statistically Significant

Note: Statistical significance is determined based on a threshold of p < 0.05. Data derived from the comparative study on the Anatomage Virtual Dissection Table.

Further analysis was conducted across the five domains pre-test and post-test scores across the five domains in the Anatomage taught group. A p-value below 0.05 indicates a statistically significant improvement after the intervention. Domains 1, 2, 3, and 5 demonstrated significant gains, while Domain 4 did not show a statistically significant change (Table 4).

Table (4): The statistical significance of the differences between pre-test and post-test scores across the five domains in the Anatomage taught group.

Memorization Test Result

This section demonstrated the knowledge retention of students in the Anatomage taught group during the midterm test after one week of Post-test (Table 5).

Domain (Short-term memory vs. Long-term memory)	Significance (p-value)	Statistical Interpretation
Domain 1: Basic Understanding	0.016	Statistically Significant
Domain 2: Anatomical Structures	0.016	Statistically Significant
Domain 3: Complex Concepts	0.001	Statistically Significant
Domain 4: Advanced Topics	0.049	Statistically Significant
Domain 5: Overall Progress	0.002	Statistically Significant

Note: Statistical significance is determined based on a threshold of $p < 0.05$. Data derived from the comparative study on the Anatomage Virtual Dissection Table.

Table (5): The statistical significance of the differences between short-term memory and long-term memory across the five domains in the Anatomage taught group.

The Post-Experiment Questionnaire

The study utilized a comprehensive post-experiment questionnaire to evaluate student perceptions and preferences regarding imaging and radiology education. The survey was structured into 10 distinct questions that focused on 4 main concepts to capture a holistic view of participants' experiences.

The Anatomage Table Integrated Method was the superior educational approach, outperforming traditional methods across every survey metric. Students reported the most significant advantages in Imaging Details (77.5%) and Knowledge Retention (72.5%), indicating that interactive 3D visualization effectively addresses traditional learning limitations. These preferences correlate with higher levels of student engagement and satisfaction across all ten evaluated categories. Ultimately, integrating this technology provides a more robust and professional-grade experience that better prepares students for real-world radiology.

Question	Key Takeaway
Q1: Personal Preference	A significant majority of students personally prefer the interactive table.
Q2: Clinical Utility	The integrated method is viewed as more effective for real-world interpretation.
Q3: Learning Motivation	The Anatomage table acts as a stronger catalyst for student engagement.
Q4: Knowledge Retention	Interactive learning makes it easier to remember complex info long-term.
Q5: Imaging Details	This is the highest margin; the table provides much clearer visualization.
Q6: Session Ease of Use	While favored, this had the narrowest margin of preference.
Q7: Diagnostic Skills	Students feel better prepared to identify pathologies accurately.
Q8: Impact on Grades	Students anticipate higher academic performance with the table.
Q9: OSCE Performance	Higher confidence for high-stakes practical examinations.
Q10: Radiology Workflows	The technology better simulates modern professional environments.

Table (6): Summary of Student Perceptions Toward Interactive Anatomage-Based Learning

The upcoming link shows the results (Questions +Percentages) of the Suray https://drive.google.com/file/d/1y0X94K1R3BRA0lXCK58mjzbag2yGBVBO/view?usp=drivesdk

Discussion

Imaging and radiology education is considered an essential component of Respiratory Care programs, as students are required to understand complex anatomical structures and accurately interpret CT and MRI images. However, traditional teaching methods often limit students' ability to correlate two-dimensional radiological images with three-dimensional anatomical relationships, which may negatively affect comprehension and knowledge retention. Although previous studies have demonstrated the educational benefits of virtual anatomy technologies, there is still limited research in Saudi Arabia evaluating the effectiveness of the Anatomage Virtual Dissection Table specifically among Respiratory Care students in imaging and radiology education (Ruisoto et al., 2012). Therefore, this study aimed to evaluate the effect of integrating the Anatomage Virtual Dissection Table compared to traditional teaching methods in delivering the medical Imaging and radiology course to Respiratory Care students at the College of Applied Medical Sciences in Jubail. The findings showed statistically significant improvements in students' academic performance and cognitive understanding following the educational intervention, reflecting the effectiveness of Anatomage as a supportive teaching tool.

Comparison of the pre- and post-tests following the educational Anatomage intervention revealed a statistically significant difference in knowledge levels after instruction, with students' scores showing clear improvement in the post-test. This indicates that the instructional strategies employed—particularly the integration of Anatomage alongside traditional lectures—contributed to enhanced comprehension and understanding. These findings are supported by a recent study that examined the use of Augmented Reality (AR) in anatomy education, which reported significant improvements in academic achievement and learning outcomes among healthcare students when interactive educational technologies were used compared to traditional methods (Aleithan et al., 2024).

Concerning the impact of integrating the Anatomage Virtual Dissection Table on Respiratory Care students' learning outcomes and academic performance in the Imaging and Radiology course, this study reveals a significant improvement in knowledge acquisition. The analysis of pre-test and post-test scores demonstrates that the majority of students achieved higher performance levels following the instructional intervention, with a statistically significant difference observed ($p < 0.05$). Specifically, students who learned through the Anatomage-integrated approach showed enhanced comprehension across all five assessment domains, indicating a consistent improvement in understanding both basic anatomical structures and complex radiological concepts. This finding is aligned with previous literature which suggests that three-dimensional virtual visualization tools like the Anatomage Table significantly enhanced students' anatomical knowledge and spatial visualization skills compared to traditional teaching methods. The integration of this technology allowed students to interact with high-resolution models in real-time, effectively bridging the gap between two-dimensional radiological images and three-dimensional anatomical relationships. Furthermore, the positive results across all learning domains confirm that the interactive nature of the Anatomage Table serves as an effective pedagogical tool for improving both short-term and long-term educational outcomes in healthcare programs.

This study had demonstrated by statistical analysis that Domain 3 (Complex Concepts) and Domain 5 (Overall Progress) were the most successful areas among the Anatomage group. Domain 3 which measures the ability to integrate spatial relationships and physiological functions achieved the highest significance in long-term retention ($p = 0.001$), proving that 3D tools excel at anchoring intricate ideas. Domain 5 a cumulative measure of total academic growth and competency maintained strong significance across both immediate learning ($P = 0.014$) and retention ($p = 0.002$), highlighting the tool's holistic effectiveness. On the other side, Domain 1 (Basic Understanding)**,** focused on fundamental terminology, and Domain 2 (Anatomical Structures), measuring the identification of physical parts, showed steady gains, Domain 4 (Advanced Topics) which assesses high-level clinical applications lacked immediate significance ($p = 0.135$) but reached a significant threshold in retention ($p = 0.049$). This suggests that while specialized content takes longer to process, the visual nature of the Anatomage table eventually solidifies these complex concepts, making the technology most transformative for deep learning compared to traditional 2D methods. For instance, a study conducted in Canada and published in BMC Medical Education reported that the integration of virtual dissection into traditional anatomy instruction significantly enhanced students' learning experience, engagement, and overall comprehension (Nicholson et al., 2019). In a similar context, Moro et al. (2017) in Australia found that the use of immersive technologies, including virtual and augmented reality, led to significant improvements in students' academic performance and engagement in anatomy education. Furthermore, Fyfe et al. (2013) demonstrated that virtual anatomy tools improve spatial visualization skills and contribute to superior academic outcomes when compared with conventional teaching methods.

The improvement observed in this study may be attributed to the interactive nature of the Anatomage Virtual Dissection Table, which enhanced student engagement, motivation, and active participation during the learning process. Technology-enhanced learning environments such as Anatomage help students better visualize complex three-dimensional anatomical structures and understand spatial relationships more effectively than traditional two-dimensional teaching methods (Curtin et al., 2017; Alasmari, 2021). In addition, previous studies have reported that virtual dissection technologies improve memory retention and long-term recall of anatomical knowledge compared with conventional teaching approaches (Wang et al., 2020; Shaffer, 2021).

The findings of this study demonstrated a significant improvement in students' learning outcomes following the instructional intervention. Most students achieved higher post-test scores compared with pre-test scores, and a statistically significant difference was observed between the two tests ($p = 0.005$), confirming the effectiveness of the Anatomage Table in enhancing academic performance. Students initially experienced some difficulty due to unfamiliarity with the technology; however, after becoming familiar with its use, they reported that it made radiology learning easier, faster, and more engaging. Participants also highlighted advantages such as improved understanding and memorization, reduced effort in studying, and better visualization of anatomical structures. In contrast, students taught using traditional methods required more time and effort to understand and retain anatomical information (Wang et al., 2020).

Despite these positive findings, the study had several limitations, including the relatively small sample size, the single-institution setting, and the short duration of exposure to the Anatomage Table, which may limit the generalizability of the results. Therefore, further research involving larger sample sizes and longer intervention periods is recommended to better evaluate the long-term educational impact of Anatomage technology (Shaffer, 2021).

Conclusion

This study evaluated the effect of integrating the Anatomage Virtual Dissection Table with traditional teaching methods on learning outcomes in imaging and radiology education. The findings demonstrated that the use of the Anatomage Table improved students' understanding of chest anatomy, academic performance, and knowledge retention. Students achieved higher post-test scores compared with pre-test scores across all evaluated domains, indicating that three-dimensional visualization and interactive learning enhance comprehension of anatomical structures and support learning of advanced anatomical and radiological concepts.

The study also showed that the Anatomage Table increased student motivation and engagement by providing an immersive, hands-on learning environment that helps visualize complex three-dimensional anatomical relationships more effectively than traditional two-dimensional methods. In addition, the interactive features of the system improved understanding, memorization, and long-term retention of anatomical knowledge by strengthening the connection between theoretical concepts and clinical imaging. Overall, the integration of Anatomage technology in anatomy and radiology education offers a valuable and effective approach for improving learning experiences and educational outcomes.

Recommendation

Recommendations for Future Research

Based on the study's findings regarding the positive impact of the Anatomage Table, the following condensed directions for future research are proposed:

- **Increase Generalizability:** Expand the participant base to larger, more diverse populations to strengthen statistical robustness and broader application.
- **Interdisciplinary Scope:** Extend research beyond Respiratory Care to assess impact across various healthcare fields.
- **Comparative Analysis:** Evaluate the efficacy of the Anatomage Table against other emerging tools like virtual reality (VR) and augmented reality (AR).
- **Long-Term Outcomes:** Shift focus toward measuring long-term knowledge retention and the direct application of these skills in clinical practice.

Recommendations for Educational Institutions

Based on the study's outcomes and aligned with existing literature, educational institutions, particularly those in Saudi Arabia, should consider the following strategies:

- **Adopt Advanced Educational Technologies**
  Integrate technologies such as the Anatomage Table to improve anatomy and radiology learning outcomes.
- **Emphasize Active Learning**
  Encourage interactive and hands-on teaching methods to enhance student engagement and understanding.
- **Ensure Resource Accessibility and Training**
  Provide sufficient technological resources and proper training for effective educational technology use.
- **Implement Blended Learning Models**
  Combine traditional teaching with advanced technologies to support diverse learning needs and improve outcomes.

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