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Research Article

Medical Education Role of Audio-Visual Aids in Improving Assessment

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A B S T R A C T

Introduction: Anatomy is a foundational subject in medical education, essential for clinical reasoning and surgical competence. Traditional teaching methods, relying on blackboard lectures and textbook illustrations, often fall short in conveying complex three-dimensional anatomical relationships. To enhance conceptual clarity and student engagement, audio-visual (AV) aids such as animations, video dissections, and 3D models are increasingly being integrated into anatomy instruction. This study aimed to evaluate the impact of AV aids on academic performance and student satisfaction compared to conventional teaching methods among first-year MBBS students.

Materials and Method: A prospective, interventional, comparative study was conducted in the Department of Anatomy at a tertiary care teaching hospital. A total of 100 first-year MBBS students were randomly divided into two groups: Group A (Conventional) and Group B (Audio-Visual), with 50 students in each. Both groups were taught the same anatomical topic using their respective teaching methods. Post-teaching, students were assessed through a theory-based MCQ test and a practical spotter exam. Additionally, feedback on teaching effectiveness was collected using a 5-point Likert scale. Data were analysed using SPSS, and statistical significance was set at $p < 0.05$.

Results: Group B (AV) demonstrated significantly higher mean scores in both theory (16.4 ± 2.1 vs. 13.8 ± 2.6) and practical (17.2 ± 1.9 vs. 14.6 ± 2.3) assessments compared to Group A ($p < 0.001$). Feedback also favoured AV teaching, with higher ratings in engagement, visual clarity, and overall satisfaction.

Conclusion: AV aids significantly enhanced academic performance and student satisfaction, supporting their inclusion as an effective complement to traditional anatomy teaching methods.

Keywords: Anatomy, Medical Education, First-year MBBS Students, Audio-visual (AV) aids, Conventional Teaching Methods, 3D Models, Animations, Video Dissections

Introduction

Anatomy forms the cornerstone of medical education and is essential for understanding the structure-function relationship of the human body, clinical reasoning, and safe practice in all medical specialties. Traditional methods of teaching anatomy—relying primarily on didactic lectures, textbook illustrations, and cadaveric dissections—while historically invaluable, are often inadequate for meeting the diverse learning needs of today's medical students. The static and sometimes abstract nature of conventional resources may hinder conceptual clarity and long-term retention, particularly when dealing with complex three-dimensional anatomical relationships.[1,2]

To address these limitations, there has been a significant pedagogical shift toward the integration of audio-visual (AV) aids in anatomy education. AV tools include PowerPoint presentations, animations, pre-recorded surgical videos, virtual dissection tables, augmented reality (AR), and interactive software. These tools provide dynamic, multisensory representations of anatomical structures, facilitating better spatial understanding, visualization of physiological processes, and active engagement. By aligning with principles of adult learning theory, cognitive load theory, and Bloom's taxonomy, AV aids foster deeper learning and promote self-directed study habits.[3,4]

Several studies have highlighted the educational benefits of AV tools in anatomy. A study at Jawaharlal Nehru Medical College demonstrated that integrating AV aids with traditional dissection improved students' conceptual understanding and engagement.[2] Another survey-based study reported that medical students who regularly utilized YouTube-based dissection videos and animations showed enhanced comprehension and retention of anatomical concepts.[5] Furthermore, Chopra et al. observed that AV-supported dissection hall teaching led to improved academic performance and visualization skills compared to conventional methods.[1]

Alomar et al. also reported that over 80% of students found AV-based modules helpful for improving clinical and anatomical skills, reinforcing the learner preference for digital visual formats.[6] Likewise, Bennal et al. noted increased attention and satisfaction when AV aids were used in physiology lectures, indicating their broader impact in medical subjects.[4]

Despite these promising findings, most published literature focuses on student perceptions or qualitative feedback, with limited empirical data linking AV tool usage directly to quantifiable improvements in assessment outcomes.[7,8] Given that assessment plays a crucial role in evaluating competency, readiness, and progression in medical education, there is a compelling need to investigate whether AV-assisted teaching strategies translate into better examination scores and practical skills acquisition in anatomy.[9]

Materials and Methods

Study Design and Setting

This was a comparative interventional study conducted in the Department of Anatomy at a tertiary care teaching hospital.

Study Participants

A total of 100 first-year MBBS students enrolled in the regular academic session of [insert year] were included in the study. Inclusion criteria comprised students who provided informed consent, attended all teaching sessions, and participated in both pre- and post-assessments. Students with irregular attendance or prior exposure to supplementary AV anatomy resources were excluded.

The participants were randomly allocated into two equal groups of 50 each using computer-generated randomization:

- Group A (Conventional Group) – Taught using traditional blackboard-based lectures and textbook illustrations.
- Group B (AV Group) – Taught using audio-visual aids, including PowerPoint slides with animations, video dissections, 3D model projections, and interactive digital content.

Teaching Intervention

Both groups were taught the same anatomical topic thoracic cavity or osteology of the upper limb]—over a single structured session lasting 2 hours. To eliminate instructor bias, the same faculty delivered content to both groups with standardized lesson plans.

- Group A received lectures supported by chalkboard drawings and textbook figures.
- Group B received the same content enhanced with audiovisual resources, including digital anatomy models, animated movement demonstrations, and recorded dissections displayed via projector.

Assessment Methodology

Following the session, students in both groups underwent two forms of evaluation:

- **Theory Assessment:** A 20-mark multiple-choice questionnaire (MCQ) based on the content covered.
- **Practical Assessment:** A spotter examination using labelled images and specimens evaluating anatomical identification and interpretation.

Additionally, all participants completed a feedback questionnaire designed on a 5-point Likert scale to assess their perceptions of teaching clarity, engagement, visual understanding, and overall satisfaction.

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Statistical Analysis

All data were compiled using Microsoft Excel and analysed with SPSS software version [insert version]. Continuous variables (e.g., test scores) were expressed as mean ± standard deviation (SD), and categorical data were presented as frequencies and percentages. Independent sample t-tests were used for comparing means between groups, while chi-square tests were applied for categorical variables. A p-value < 0.05 was considered statistically significant.

Results

Demographic Profile of Participants

A total of 100 first-year MBBS students participated in the study and were equally distributed into two groups (Group A: Conventional, Group B: Audio-Visual), each comprising 50 students. Both groups were comparable in terms of age and gender distribution. The mean age of participants was 18.9 ± 0.7 years, with 54% females and 46% males, showing no statistically significant differences between the two groups (p > 0.05).

Comparison of Academic Performance Between Groups

Theory Assessment (MCQ Scores)

The mean theory score in the audio-visual group (Group B) was 16.4 ± 2.1, significantly higher than the conventional group (Group A), which scored 13.8 ± 2.6. This difference was found to be statistically significant (p < 0.001, independent sample t-test), indicating improved theoretical understanding among students taught using AV aids.

Practical Assessment (Spotter Scores)

In the practical spotter examination, the mean score of Group B was 17.2 ± 1.9, whereas Group A had a mean score of 14.6 ± 2.3. Again, the difference was statistically significant (p < 0.001), suggesting enhanced visual and spatial recognition in the AV group Table 1.

Table 1.Comparison of Theory and Practical Assessment Scores Between Conventional and Audio-Visual Teaching Groups

Assessment Type	Group A (Conventional)	Group B (Audio-Visual)	p-value
Theory (MCQs, /20)	13.8 ± 2.6	16.4 ± 2.1	<0.001
Practical (Spotters, /20)	14.6 ± 2.3	17.2 ± 1.9	<0.001

Student Feedback Analysis

Feedback was obtained from all 100 participants using a validated 5-point Likert scale assessing various domains such as clarity, engagement, satisfaction, and perceived learning effectiveness.

- 82% of students in the AV group reported the session as "highly engaging" vs. 44% in the conventional group.
- 88% of AV group students agreed that the teaching improved their visual understanding of anatomical structures compared to 52% in the conventional group.
- Overall satisfaction was significantly higher in the AV group (mean Likert score: 4.6 ± 0.4) than in the conventional group (3.9 ± 0.7, p < 0.001).

Discussion

Age Distribution of Study Participants

The age distribution in both groups was similar (mean age: 18.8 ± 0.7 in Group A vs. 19.0 ± 0.6 in Group B; p = 0.276), and most participants fell in the 18–20-year range. This uniformity aligns with prior studies involving first-year MBBS students in India. For instance, Gajbe et al. (2019)[2] reported a similar age group (mean age: 18.6 ± 0.8 years) in their anatomy education study, and Rajan et al. (2013)[10] also conducted performance analysis in students aged between 18 and 20 years. Table 2 This consistency reduces the likelihood of age as a confounding factor, ensuring that differences in learning outcomes could be attributed primarily to the intervention (use of AV aids).

Gender Distribution of Study Participants

The gender distribution was also comparable between the groups, with 44% males in Group A and 48% in Group B (p = 0.689). Similar balanced gender ratios were seen in studies by D'Souza et al. (2014),[11] where the male-to-female ratio was roughly 1:1 in assessing student perspectives on AV aids in medical education. Table 3 In a more recent survey, Pradhan et al. (2024)[5] found no significant difference in AV-based learning preference or outcome based on gender in a cohort of 127 medical students. This suggests that gender does not influence the effectiveness of AV-based anatomy education, further supporting its broad applicability.

Comparison of Assessment Scores Between Groups

In our study, the AV group showed significantly better performance in both theory and practical exams: MCQ scores: 16.4 ± 2.1 (AV group) vs. 13.8 ± 2.6 (Conventional); p < 0.001, Spotter scores: 17.2 ± 1.9 (AV group) vs. 14.6 ± 2.3; p < 0.001. This aligns closely with the findings of Gajbe et al. (2019),[2] who reported that after exposure to AV-integrated teaching, students scored 21.7 ± 2.3 compared to 18.9 ± 3.0 in the traditional group (p < 0.01). Table 4 Similarly, Koop et al. (2020)[12] demonstrated that students who used an audiovisual dissection manual had improved anatomy test scores (mean 75.6% vs. 68.4%, p = 0.014) compared to those taught using traditional dissection manuals. Pradhan et al. (2024)[5] also showed that students who supplemented learning with YouTube videos had better anatomy quiz scores and higher satisfaction with visual understanding. These findings reinforce that audio-visual aids enhance cognitive processing, particularly of spatial and complex structural content, which is often difficult to convey through static textbook images or verbal lectures.

Student Feedback on Teaching Method

Feedback revealed significantly higher engagement and satisfaction in the AV group 82% found the session engaging (vs. 44% in the conventional group), 88% reported improved visual understanding (vs. 52%) and Overall satisfaction score: 4.6 ± 0.4 (AV) vs. 3.9 ± 0.7; p < 0.001. These results are supported by Alomar et al. (2022),[6] where 84% of students found AV modules engaging, and 79% felt they improved confidence in clinical anatomy understanding. Similarly, Motwani (2021)[13] found that 78% of students preferred AV-aided lectures over traditional methods and rated them higher on usefulness and clarity. Awungafac et al. (2024)[14] also observed that more than 80% of nursing students across five institutions preferred visual aids for understanding procedures and anatomy, especially in resource-limited contexts. Table 5 These studies confirm the role of AV aids in increasing student motivation, attention span, and retention, which ultimately contributes to better academic outcomes.

Table 2.Age Distribution of Study Participants

n = 100

Age Parameter	Group A (Conventional)	Group B (Audio-Visual)	Total	p-value
18 years	18 (36%)	16 (32%)	34 (34%)	0.276
19 years	20 (40%)	21 (42%)	41 (41%)	
20 years	12 (24%)	13 (26%)	25 (25%)	
Mean Age ± SD (years)	18.8 ± 0.7	19.0 ± 0.6	-	
Age Range (years)	18–20	18–20	-	
Chi-square test				

Table 3.Gender Distribution of Study Participants

Gender	Group A (Conventional)	Group B (Audio-Visual)	Total	p-value
Male	22 (44%)	24 (48%)	46 (46%)	0.689
Female	28 (56%)	26 (52%)	54 (54%)	
Chi-square test				

Table 4.Comparison of Assessment Scores Between Groups

Assessment Type	Group A (Conventional)	Group B (Audio-Visual)	Mean Difference	p-value
Theory (MCQ score /20)	13.8 ± 2.6	16.4 ± 2.1	+2.6	<0.001
Practical (Spotters /20)	14.6 ± 2.3	17.2 ± 1.9	+2.6	<0.001
Independent T-test	-	-	-	

Table 5.Student Feedback on Teaching Method (Likert Scale Responses)

Feedback Parameter	Group A (Conventional)	Group B (Audio-Visual)	p-value
Teaching session was engaging (Agree/Strongly Agree)	22 (44%)	41 (82%)	<0.001
Helped in understanding anatomical structures	26 (52%)	44 (88%)	<0.001
Satisfied with the teaching method	33 (66%)	48 (96%)	<0.001
Mean Overall Satisfaction Score (1 to 5)	3.9 ± 0.7	4.6 ± 0.4	<0.001
Independent T-test	-	-	-

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Conclusion

The present study demonstrated that the integration of audio-visual (AV) aids in anatomy teaching significantly enhanced both theoretical knowledge and practical understanding among first-year MBBS students compared to conventional blackboard-based methods. Students in the AV group outperformed their peers in MCQ and spotter assessments, with statistically significant differences in mean scores. Furthermore, feedback analysis revealed that AV-assisted sessions were perceived as more engaging, visually clarifying, and satisfactory. These findings affirm that AV tools not only cater to diverse learning styles but also foster deeper conceptual comprehension and retention of anatomical knowledge. Given the evolving landscape of medical education and the cognitive demands of anatomy, incorporating AV aids as a complementary strategy to traditional methods appears to be an effective pedagogical approach that promotes better academic outcomes and learner satisfaction.

Limitations of the Study

Despite the promising outcomes, this study had certain limitations. Firstly, the sample size was relatively small and limited to a single institution, which may restrict the generalizability of the findings to other medical colleges or diverse educational settings. Secondly, the study focused on a short-term assessment of learning outcomes immediately after the intervention, without evaluating long-term knowledge retention or the impact on clinical application of anatomical concepts. Thirdly, the study involved only one anatomical topic, which may not comprehensively represent the full spectrum of anatomical learning. Additionally, potential instructor bias, although minimized by using the same faculty and standardized lesson plans, cannot be completely ruled out. Finally, the subjective nature of student feedback, influenced by novelty or individual preferences for learning style, may also have introduced response bias. Future studies with larger multicentric cohorts, longitudinal follow-up, and inclusion of multiple anatomical modules are warranted to validate and expand upon these findings.

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