



## MEDICAL STUDENTS' PERCEPTIONS OF ANATOMY AND HISTOLOGY LEARNING IN THE ERA OF MODERN MEDICAL EDUCATION

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### Abstrak

**Background:** Anatomy and histology are fundamental components of medical education; however, students frequently perceive these subjects as difficult and heavily reliant on memorization. The increasing use of digital learning tools, including virtual microscopy (VM) and three-dimensional (3D) anatomical models, offers new opportunities to enhance student engagement and conceptual understanding. **Objectives:** This study aimed to describe medical students' perceptions of anatomy and histology learning in the context of modern medical education and to identify potential implications for curriculum improvement. **Methods:** A descriptive cross-sectional study was conducted among 341 undergraduate medical students. Data were collected using a validated structured questionnaire distributed via Google Forms. Descriptive statistical analysis was performed to summarize students' perceptions of anatomy and histology learning. **Results:** Most students reported positive perceptions of anatomy (97.9%) and histology (94.4%) learning, predominantly within the "good" and "very good" categories. Female students constituted the majority of respondents (82.1%), and most participants were aged 20–21 years. The findings indicate that learning strategies integrating clinical relevance and digital educational tools were perceived as effective in supporting student understanding. **Conclusion:** Medical students demonstrated predominantly positive perceptions of anatomy and histology learning, reflecting the effective implementation of clinically integrated and technology-enhanced teaching approaches. Continuous student feedback, balanced blended learning models, and ongoing faculty development are recommended to maintain and further improve the quality of undergraduate medical education.

**Keywords:** *anatomy learning; histology; medical education; student perception; blended learning*

## INTRODUCTION

Anatomy and histology constitute core foundations of medical education, equipping students with essential knowledge of human structure and function that underpins clinical reasoning and patient safety<sup>1</sup>. Despite their fundamental importance, these subjects are frequently perceived as challenging due to extensive

content coverage, high memorization demands, and difficulties in linking basic science concepts to real clinical contexts. Several studies have reported student dissatisfaction with overly traditional anatomy teaching methods and emphasized the need for stronger clinical integration to promote meaningful and long-term understanding<sup>2</sup>.

In histology education, rapid advances in instructional technology have introduced new learning dynamics. Virtual microscopy (VM) and the digitalization of histological slides allow broader access, standardized materials, and flexible learning environments that support blended learning approaches. Systematic reviews indicate that VM enhances learning experiences in microscopic anatomy and is well accepted by students, while maintaining conceptual understanding comparable to conventional methods<sup>3</sup>. Nevertheless, light microscopy remains valuable for developing hands-on technical skills, suggesting that a hybrid instructional approach may be optimal<sup>4</sup>. Previous studies have shown that blended learning strategies incorporating VM in histology laboratories improve both learning outcomes and student perceptions<sup>5</sup>. From a curricular perspective, global trends in health professions education advocate a transition toward competency-based, clinically relevant, and socially responsive learning models supported by quality assurance mechanisms<sup>6</sup>. Policy frameworks from the World Health Organization emphasize reform in instructional design, governance, and continuous evaluation to enhance the relevance and effectiveness of medical education<sup>1</sup>. In parallel, international educational agendas highlight the responsible integration of technology to support sustainable and human-centered learning environments<sup>7</sup>.

Recent evidence further supports the vertical integration of anatomy teaching into clinical phases, as well as explicit linkage of anatomical and histological concepts with clinical scenarios to improve students' confidence and performance<sup>8</sup>. Additionally, the use of three-dimensional and virtual models in anatomy education has been reported to enhance spatial understanding, addressing limitations of two-dimensional learning resources<sup>9</sup>. Collectively, these findings underscore the importance of evaluating

medical students' perceptions of anatomy and histology learning as a basis for continuous curricular and instructional improvement.

## CONTENT

### METHODS

#### Study Design

This study employed a descriptive cross-sectional design to assess medical students' perceptions of anatomy and histology learning at a single point in time. This design was selected because it is appropriate for describing perceptions without intervention or follow-up and is commonly applied in perception- and satisfaction-based research in medical education<sup>8</sup>. The descriptive approach enabled a systematic depiction of students' views regarding anatomy and histology learning experiences.

#### Study Context

The study was conducted within the preclinical phase of an undergraduate medical program, where the curriculum emphasizes foundational understanding of human structure and function through anatomy and histology modules. Data collection took place during the even semester of the 2024/2025 academic year.

#### Participants and Sampling

The study population comprised all active undergraduate medical students at early and intermediate levels who had completed anatomy and histology courses in the current academic year. A total sampling technique was applied, whereby all eligible students were invited to participate to ensure comprehensive representation of a relatively homogeneous population, as commonly recommended in medical education perception studies<sup>9</sup>.

Inclusion criteria were: active medical students who had completed anatomy and histology modules, and willingness to participate by completing the questionnaire in full.

Exclusion criteria included incomplete questionnaire responses and duplicate or invalid data entries.

### Instrument and Data Collection

Data were collected using a structured questionnaire developed based on a review of contemporary medical education literature and adapted to the context of anatomy and histology learning. The instrument consisted of three main components: perceptions of anatomy learning (10 items), perceptions of histology learning (10 items), and general aspects of the learning process and supporting facilities. All items were rated on a four-point Likert scale (1 = strongly disagree to 4 = strongly agree). Content validity was assessed through expert review in medical education, and internal consistency reliability was evaluated using Cronbach’s alpha, with values  $\geq 0.7$  considered acceptable, in line with established recommendations<sup>10</sup>. The questionnaire was distributed via Google Forms to facilitate accessibility and reduce administrative bias, a method widely used in online medical education surveys<sup>11</sup>.

### Data Analysis

Data were analyzed using descriptive quantitative methods with statistical software.

Frequencies and percentages were calculated to summarize students’ perceptions across categories (“very good,” “good,” and “poor”) for anatomy and histology learning. Descriptive analysis was chosen to align with the study objective of identifying perception trends rather than testing causal relationships<sup>12</sup>.

### Ethical Considerations

The study adhered to ethical principles for research involving human participants, including informed consent and data confidentiality. Participation was voluntary, with consent obtained electronically prior to questionnaire completion. All data were anonymized to protect respondent identity. These procedures were conducted in accordance with the Declaration of Helsinki and World Health Organization research ethics guidance<sup>13</sup>.

## RESULTS

A total of 341 undergraduate medical students participated in this study. Most respondents were female (82.1%), while male students accounted for 17.9%. The largest age group was 20–21 years, comprising 76.3% of the sample, followed by students aged 19 years (14.7%). This demographic distribution reflects the typical composition of undergraduate medical cohorts in early and intermediate preclinical phases

**Table 1.** Demographic Characteristics of Respondents and Students’ Perceptions of Anatomy and Histology Learning

Variable	Category	n	%
Sex	Male	61	17,9
	Female	280	82,1
Age (years)	18	7	2,1

	19	50	14,7
	20	150	44,0
	21	110	32,3
	22	22	6,5
	23	341	0,6
<b>Histology Category</b>	Very Good	97	28,4
	Good	225	66,0
	Poor	19	5,6
<b>Anatomy Category</b>	Very Good	116	34,0
	Good	218	63,9
	Poor	7	2,1

*Source; Primary Data , 2025*

## DISCUSSION

This study demonstrates that undergraduate medical students generally hold positive perceptions of anatomy and histology learning, with more than 90% of respondents rating both subjects as “good” or “very good.” These findings suggest that current instructional strategies implemented in the preclinical curriculum are largely effective in meeting students’ learning expectations. Similar trends have been reported in previous studies indicating that student satisfaction increases when foundational sciences are delivered using learner-centered and clinically relevant approaches<sup>14</sup>.

The highly positive perception of anatomy learning observed in this study (97.9%) may be attributed to the integration of visual and clinically oriented teaching methods. The use of three-dimensional anatomical models, multimedia resources, and clinical correlations can facilitate spatial understanding and help students contextualize anatomical knowledge within clinical practice. Prior research has shown that technology-enhanced anatomy education improves concept retention,

engagement, and learner satisfaction compared with traditional didactic approaches alone<sup>15</sup>. Furthermore, vertical integration of anatomy into clinically oriented learning has been associated with increased student confidence and perceived relevance of anatomical knowledge<sup>16</sup>.

In histology learning, the majority of students also reported favorable perceptions (94.4%), reflecting the effective adoption of digital tools such as virtual microscopy (VM). VM allows flexible access to standardized histological slides and supports self-directed learning, which has been shown to enhance learning efficiency and student satisfaction<sup>15</sup>. Meta-analytic evidence suggests that VM is comparable to, and in some contexts superior to, conventional light microscopy in supporting conceptual understanding<sup>8</sup>. However, the presence of a small proportion of students reporting less favorable perceptions (5.6%) highlights that exclusive reliance on digital modalities may not fully address the need for hands-on laboratory skill development. Consistent with previous studies, a blended approach combining VM with limited light

microscopy practice appears to be the most pedagogically balanced strategy<sup>17</sup>.

From a broader curricular perspective, these findings align with global recommendations advocating competency-based, clinically integrated, and technology-supported medical education<sup>18</sup>. The World Health Organization emphasizes continuous evaluation of educational processes to ensure relevance, quality, and responsiveness to learner needs<sup>19</sup>. Evaluating students' perceptions, as conducted in this study, therefore serves as an important quality indicator and provides empirical input for curriculum refinement.

Despite its strengths, this study has limitations. The cross-sectional design captures perceptions at a single time point and does not account for changes over time or their relationship with academic performance. In addition, reliance on self-reported data may introduce social desirability bias. Future research employing longitudinal or mixed-method designs is warranted to explore how perceptions evolve throughout medical training and how they relate to learning outcomes and clinical competence.

Overall, the findings underscore that positive student perceptions are closely linked to the integration of clinical relevance and educational technology. Sustaining these approaches, while addressing identified gaps through balanced instructional design and continuous feedback, is essential for improving the quality of foundational medical education.

## SIMPULAN

This study demonstrates that undergraduate medical students generally hold positive perceptions of anatomy and histology learning within the context of modern medical education. The high proportion of “good” and “very good” ratings indicates that teaching approaches integrating clinical relevance and digital learning technologies have been effective in supporting student engagement and understanding. The use of visual resources, clinical correlations, and virtual microscopy appears to play a significant role in shaping favorable learning experiences in both subjects

Nevertheless, the presence of a small proportion of students reporting less positive perceptions suggests that opportunities for improvement remain, particularly in optimizing instructional delivery, laboratory practice, and student–faculty interaction. Overall, these findings highlight the importance of regularly evaluating students' perceptions as a practical indicator of educational quality and as a basis for continuous curriculum development in foundational medical sciences.

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