

Evaluating the Effectiveness of Anatomy Teaching Among Students

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Abstract. This article presents the results of a study on the effectiveness of students' mastery of anatomy. The study was conducted among 1st and 2nd-year students, with 127 participants. The results indicate that students consider the use of visual resources effective when studying anatomy. Specifically, 60.8% of 1st-year students and 70.7% of 2nd-year students reported using visual materials as their primary learning aid. It was also found that teaching methodology and interactive methods significantly impact student interest and knowledge acquisition. The findings showed that 2nd-year students are more oriented toward independent study and digital resources, whereas 1st-year students have a greater need for adaptation and practical sessions.

Keywords: anatomy, students, teaching effectiveness, visual resources, teaching methodology, assessment system

Introduction. Improving the quality of education and effectively assessing student knowledge are pressing issues in modern higher education (6). The teaching of human anatomy within the higher education system is conducted in two primary forms, with practical classes holding a central place in the educational process. Furthermore, the quality of a physician's professional activity largely depends on their level of training, and the opportunities for its significant improvement are directly embedded in the educational process of a medical university (1). The teaching of anatomy in a medical university should be viewed as an integrated system that includes modern educational equipment, e-learning opportunities, a competency-based approach to instruction, and the high qualifications of the instructor (5). Studies have shown that more than half of respondents (58.1%) consider anatomy to be a core discipline for their future professional activities. For in-depth study and effective mastery of the subject, students often use additional resources. In particular, the vast majority of those surveyed prefer using various video materials in their learning process (93.5%), while more than half turn to supplementary literature (65.6%). A portion of students finds using 3D anatomy atlases convenient (4.3%), whereas the share of those using classic anatomical atlases is very small, at 2.2% (3). When learning anatomical terms, 51% of first-year students memorize them mainly through repeated reading; for second-year students, this figure was 38.7%. However, it was found that an average of 34.7% of first- and second-year students prefer to learn

terms using drawings, diagrams, and models ($p \leq 0.001$). 54.7% of first- and second-year students attribute the difficulty in mastering anatomy to the challenge of memorizing anatomical terms ($p \leq 0.001$) (4). A systemic approach, which integrates various resources, is considered the most effective for teaching modern anatomy. It promotes long-term knowledge retention among students, reduces the need for repetition, and strengthens the connection to real clinical cases. Moreover, a highly motivated student assimilates information better and is able to directly link anatomical knowledge with practice (2).

Objective. To evaluate the impact of visual materials and modern pedagogical methods on the effectiveness of students' anatomy comprehension.

Materials and Methods. The research was conducted among first and second-year students of Kimyo International University in Tashkent. A total of 127 students participated in the study, with 51 from the first year and 75 from the second year. The primary research method was a questionnaire survey. The data obtained were analyzed to assess the level of learning material mastery and to identify factors influencing learning effectiveness.

The collected data were processed and statistically analyzed, during which the mean (M), standard deviation (σ), and standard error of the mean ($\pm m$) were determined. Student's t-test was used to assess the statistical significance of the differences. Differences were considered statistically significant at a significance level of $p \leq 0.001$.

Results and Discussion. According to a survey conducted among first- and second-year students, the students noted that using visual materials in their study of anatomy is more beneficial and plays a leading role in memorization. Thus, 60.8% of first-year students and 70.7% of second-year students stated that they primarily use visual sources ($p \leq 0.01$). The proportion of students in both years who do not use visual materials was 6.5% on average, whereas the proportion of those who use them from time to time was 27.7% on average ($p \leq 0.05$).

The level of visual source usage by first-year students was high, averaging 78.4%, which is 1.2 times higher than that of second-year students (Table 1).

Table 1

Student usage of visual sources, %

Source	1st year		2nd year		p≤
	M	±m	M	±m	
3D models, anatomical atlases	33.3	1.85	20.1	2.32	0.001
Videos on YouTube, various websites, and platforms	45.1	1.96	52.0	2.90	0.05
Presentations	13.7	1.35	24.2	2.48	0.001

Artificial intelligence	7.8	1.06	4.1	1.14	0.05
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To assess the anatomy teaching methodology, the instructor's ability to engage students, the methods used, and the fairness of the grading system, the following responses were obtained from the respondents to our questions. According to the results, the average percentage of students from both years who noted that the teaching methodology is of very great importance was 65.1%. Furthermore, when considering lesson effectiveness based on the teaching method, it was found that the number of 1st-year students (43.2%) who consider lessons conducted as group interactive games or based on practical tasks with drawings to be effective and convenient is 1.5 times higher than that of 2nd-year students (28%). Regarding the grading system, 73.3% of 2nd-year students believe it is objective, while 47.1% of 1st-year students believe that grading is not always fair ($p \leq 0.001$) (Table 2).

Table 2

Answer options	1st-year		2nd-year		p≤
	M	±m	M	±m	
How does the instructor's teaching style affect your attitude toward learning?					
It has a very significant influence	52.9	1.96	77.3	2.43	0.001
It has no influence	47.1	2.97	22.7	3.25	0.001
Which teaching method could make studying anatomy easier for you?					
Group work using various interactive methods	45.1	1.96	25.3	2.52	0.001
Individual questioning of one student	13.7	1.35	44	2.88	0.001
Assessment based on practical exercises, drawings, or models	41.2	1.94	30.7	2.68	0.01
In your opinion, how fair is the grading system for anatomy?					
Yes, always fair	37.2	1.90	73.3	2.57	0.001
No, unfair	15.7	1.43	2.7	0.94	0.001
Not always	47.1	1.96	24	2.48	0.001

58.2±2.41% of first- and second-year students noted that more practical classes are needed to improve the learning of anatomy; however, these figures did not show a significant difference. The number of students who believed the academic workload should be reduced was almost 1.7 times higher among first-year students ($p \leq 0.01$). The "simplification of educational materials" option was selected by second-year students approximately 1.2 times more often than by first-year students, which reflects a growing need for a structured presentation of material at later stages of education. Preparing online resources for self-study was also more important for second-year students, who chose this option approximately 1.3 times more often, than first-year students. This indicates that senior students are more oriented toward independent work and the use of digital educational resources (Figure 1).

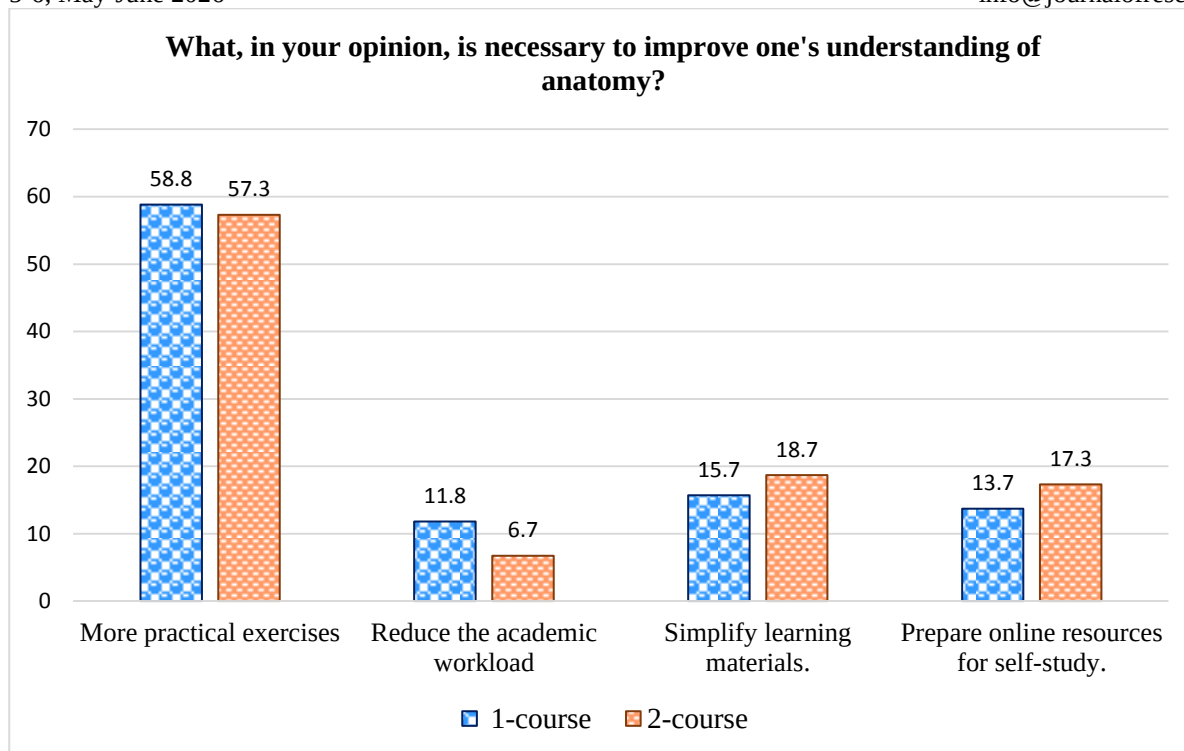


Figure 2. Opinions of first- and second-year anatomy students regarding self-study, expressed as a percentage.

Overall, the obtained ratios demonstrate a shift in educational priorities from the adaptation needs of first-year students to the more conscious and independent learning of second-year students.

Conclusion. The study showed that the grading system and anatomy teaching methods have a statistically significant impact on student motivation and knowledge acquisition. It was established that for first-year students, the teaching style and interactive group learning methods are most important, which is related to their adaptation to the higher education environment. At the same time, second-year students significantly more often noted the fairness of the grading system and preferred practice-oriented classes, the use of models, and elements of independent study ($p \leq 0.001$). The data obtained confirm that a combination of interactive, practical, and independent forms of learning helps to increase the effectiveness of anatomy instruction.

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