ONLINE FIRST



**ISSN:** 0015-5659

**e-ISSN:** 1644-3284

# Opinions of doctors and students regarding teaching aids used during human anatomy course in medical faculties assessed with a questionnaire

**Authors**: Jarosław Fugiel, Anna Rohan-Fugiel, Bartosz Poniewierka, Adam Wiatkowski, Marek Syrycki, Dominika Domagała

**DOI:** 10.5603/fm.101743

**Article type:** Original article

**Submitted:** 2024-07-25

**Accepted:** 2024-10-16

**Published online:** 2025-03-06

# Opinions of doctors and students regarding teaching aids used during human anatomy course in medical faculties assessed with a questionnaire

Jarosław Fugiel[1, 2], Anna Rohan-Fugiel[3], Bartosz Poniewierka[4], Adam Wiatkowski[4], Marek Syrycki[2, 3] Dominika Domagała[2, 3]

[1]Division of Biostructure, Wroclaw University of Health and Sport Sciences, Wrocław, Poland

[2]Polish Anatomical Society, Wroclaw Division

[3]Division of Anatomy, Department of Human Morphology and Embryology, Wroclaw Medical University, Wrocław, Poland

[4]Wroclaw Medical University, Wrocław, Poland

Address for correspondence: dr hab. Jarosław Fugiel, prof. AWF, Division of Biostructure, Wroclaw University of Health and Sport Sciences, al. I. J. Paderewskiego 35, 51–612 Wrocław, Poland; e-mail: jaroslaw.fugiel@awf.wroc.pl

## ABSTRACT

**Background:** The human anatomy course is a fundamental subject in medical education. Understanding the structure and topography of the human body is essential for the years to come and is vital in a doctor's career. Quality education for future doctors is key to teaching process which requires adequate equipment to ensure proper level of training. This concerns the need to create several dissecting rooms to accommodate preserved specimens and whole corpses. It is also necessary to

employ teaching, laboratory and technical staff with appropriate competences and experience. Various educational resources have been introduced recently to support anatomy education and enhance teaching, such as virtual anatomical tables and digital anatomical applications, which are already being used by some universities. However, the question remains: can these new methods replace traditional teaching ones? Should the virtual experience prevail over cadaver dissection, during anatomy course?

The objective of the study was to gather opinions from doctors and medical students on the effectiveness of teaching human anatomy using anatomical preparations, cadaver dissection, digital applications and other resources to support the educational process.

**Materials and methods:** A total of 962 participants joined the study, including 127 doctors (20 residents and interns) and 835 students (154 first year students and 681 second- to sixth-year students). The study employed a diagnostic survey method, using a questionnaire as the primary tool. In the section of the questionnaire where respondents were asked to evaluate educational resources for teaching human anatomy, they were asked to assess the effectiveness of learning through anatomical preparations, cadaver dissection and digital anatomical applications. The frequency of responses (in percentages) was calculated and differences between doctors and students were analysed using chi-square test.

**Results:** Majority of respondents agreed that anatomical knowledge is important for other subjects in later years of medical studies and for future professional work. This opinion was shared by both doctors and medical students. Similar amount of respondents also considered anatomical preparations and human cadavers to be the most effective way to teach anatomy. Virtual programs are seen as an interesting and useful additional teaching tool, but they cannot replace hands-on experience in the form of dissection. This was expressed by both doctors and medical students.

**Conclusions:** Knowledge of human anatomy is a basic requirement for doctors and the skills acquired through practical classes using anatomical preparations and autopsies are extremely important. Digital

anatomical programs are useful as an additional resource in the educational process but cannot replace dissection room classes where students gain hands-on experience in actual cadaver preparation.

**Keywords: anatomy, doctors, students, anatomical preparations, digital anatomical applications**

## INTRODUCTION

During medical school, the human anatomy course is core subject, regardless of chosen specialization [17, 20]. Knowledge of body's structure, its details and topography, acquired through direct contact with anatomical preparations and cadavers, is used in subsequent years of study and is foundation of all fields of medicine [15]. Anatomical knowledge is essential for physical exams, assessment of patient's functional status, interpretation of MRI or X-ray images and performance of invasive procedures. It ties all branches of medicine together and affects the accuracy of treatment selection. Medical errors resulting from the lack of anatomical knowledge have resulted in a significant number of complaints against doctors in recent years [3]. The decline in anatomical knowledge among doctors has been observed in many countries [1, 5, 8, 13, 18] and is a concern in the medical community.

To maintain the quality of education, several factors have to be considered. To begin with, students have to be provided with the appropriate equipment. This includes setting up dissection rooms for specimens and whole bodies. Further, teaching, laboratory and technical staff with relevant expertise are required so that students can explore human anatomy through studying specimens and dissection.

Currently, medical courses are offered at 36 universities in Poland. From the perspective of ensuring the quality of education, the fact that Polish Accreditation Committee issued a negative assessment to eleven universities that started educating students in the academic year 2023/2024 seems to be disturbing. The available information shows that seventeen universities that launched medical courses

this year (as of August 1, 2023) do not have a dissecting room for teaching human anatomy classes. [4].

## Objectives

The aim of this study was to gather opinions of doctors and medical students on the effectiveness of teaching human anatomy using anatomical preparations, cadavers and digital anatomical applications. The authors wanted to answer the question: Can we rely solely on anatomical multimedia applications to prepare students for their future work as doctors? And if not, what are other ways to meet the curriculum requirements for knowledge, skills and competencies in medical studies.

## MATERIALS AND METHODS

The study was conducted in 2023 after the start of the 2023/2024 academic year involving a study group of doctors and medical students. A total of 982 participants joined, including 127 doctors (20 residents and interns) and 835 students, 154 first year students and 681 second- to sixth-year students. The research used diagnostic survey method, survey as a technique and questionnaire created by the authors of the project. The questionnaire included a data sheet for the following variables: gender, age, professional status, specialty, professional experience and place of study or work. In the section dedicated to teaching tools for human anatomy, respondents were asked to evaluate the effectiveness of anatomical preparations, cadaver dissections and digital anatomical applications, 9 questions in total. The content validity of the questionnaire was assessed by expert judges in anatomy. Reliability of the questions was examined by the repeated measurements (test-retest), which involved retaking the same questionnaire by selected respondents (20 respondents). The results showed high consistency of responses. Quantitative data were presented as frequency (in %). Differences between doctors and medical students were determined using the chi-squared test.

## RESULTS

The study involved 962 people, including 127 doctors and 835 students. Table 1 presents the number of people in the individual groups of doctors and students divided by gender.

The age of the students ranged from 18 to 30 years. The average age of the physicians was 46 years. The group of practicing doctors taking part in survay (excluding residents and interns) included:

- 33 people under 40 years of age (26%),
- 57 people in the age group from 40 to 50 years (45%),
- 22 people from 50 to 60 years of age (17%),
- 15 people over 60 years of age (12%).

Among the doctors who participated in the study, the most common specializations were internal medicine and family medicine, with 23 respondents (18%) each. Other notable specializations included gynecology and obstetrics, with 14 respondents (11%) each, and general and orthopedic surgery, with 13 respondents (10%) each.

Two initial questions in the study asked for respondents' views on the importance of anatomical knowledge for other subjects in later years of medical training and in their careers as physicians. When asked about the relevance of anatomy in professional practice, 88% of doctors, 93% of first-year students, and 76% of second- to fifth-year students responded that it was fairly or highly important (Fig. 1). There was no significant difference in the overall frequency of such responses between doctors and students ($p = 0.46$). However, second- to fifth-year students rated anatomy as “very important” significantly less frequently ($p = 0.00$).

Similar patterns emerged when asked about the role of anatomical knowledge in other subjects during subsequent years of study. First-year students were excluded from this analysis. The majority of respondents, including doctors and students, indicated that anatomical knowledge was important for

other subjects, although fewer rated it as ‘very important’ compared to the previous question (Fig. 2). There were no statistically significant differences between doctors and students in the ‘important’ and ‘very important’ responses ($p = 0.66$), although doctors significantly more often selected the response ‘very important’ ($p = 0.04$).

The following questions addressed the use of teaching tools in anatomical education. Respondents were asked about their opinions on multimedia programs and virtual applications, as opposed to more traditional methods involving anatomical preparations and human cadavers. The majority of respondents believed that learning anatomy without anatomical preparations or cadavers is ineffective. This view was shared by 80% of doctors, 72% of first-year students, and 86% of those at more advanced academic stages (Fig. 3). First-year students less frequently share this opinion, although the difference between doctors and students was not statistically significant ($p = 0.89$) (Tab. 2).

With regards to the substitution of human cadavers and anatomical preparations with multimedia programs, the majority of respondents, including 69% of doctors, 88% of first-year students and 91% of students of subsequent years, agreed that virtual teaching could not replace traditional methods (Fig. 4). Although doctors provided this response less frequently than students, the difference was not statistically significant ($p = 0.93$).

Respondents were also asked about the most effective methods for teaching anatomy. Most of them believed that practical experience in dissecting room, using anatomical preparations and cadavers, was the most effective approach. When asked whether virtual anatomy programs should replace cadavers and anatomical preparations, a significant proportion rejected this idea, stating that multimedia programs should only complement traditional dissecting room exercises. Among doctors, 76% gave this response, compared to 88% of first-year students and 95% of students of subsequent years (Fig. 5). Although doctors provided this answer less frequently than students, the difference was not statistically significant ($p = 0.16$).

## DISCUSSION

Those involved in establishing educational standards for medical faculties, along with students and physicians, recognize the critical importance of anatomical knowledge for a physician's future practice. Anatomy serves as the foundation for subsequent clinical subjects and is indispensable for professional work. As a fundamental discipline for medical students, it provides the basis for subsequent clinical studies and is essential for effective practice. The extensive volume and intricate detail of the material requires a significant investment of time and effort from students, who have to demonstrate a high level of commitment to attain mastery [17]. This frequently results in students seeking alternative methods to enhance their learning, both at home and in the dissection room. Such methods include self-study and problem-based learning. Additionally, computer-based multimedia programs and virtual anatomy tables are being developed to supplement and enhance the study of anatomy. However, despite the continuous development of teaching techniques and tools, emerging research indicates that the level of anatomical knowledge among physicians may still be insufficient. Studies by Waterston et al. [21], McKeown et al. [12], and Rainsbury and Mahadevan [16] provide evidence of this concern.

In Poland, recent reports indicate that some universities offering medical courses are adopting virtual programs to teach human anatomy, potentially diminishing students' access to anatomical preparations. However, it is crucial to note that even the manufacturers of these programs assert that their products are intended as auxiliary tools, designed to complement, not replace, traditional dissection practices.

The evaluation conducted by Polish Accreditation Commission indicates that newly established medical faculties frequently lack adequate teaching facilities and infrastructure. One university received a negative assessment from the Commission while seventeen others did not possess the necessary foundational equipment to facilitate effective teaching in anatomical dissecting rooms. Training standards for medical students clearly outline the knowledge and skills required in the field of

human body structure. Teaching anatomy using specimens and human cadavers is so-called ‘gold standard’ among renowned universities worldwide, upholding this practice ensures the highest quality education for trained professionals. While learning from anatomical atlases or computer programs offers a general understanding of the body structure, modern technologies can only present individual systems and organs in an appealing manner. With this in mind, nothing can replace direct experience of interaction with the human body, its complexities, and individual differences [2, 9]. Thus, errors during surgical procedures may result from a lack of understanding of human anatomical variability. Furthermore, the preparation of cadavers enables students to cultivate social competencies, respect for the human body, humility, and responsibility qualities that cannot be adequately conveyed using virtual reality substitutes.

The quality of education at medical faculties is not solely determined by the availability of adequate dissecting room equipment. It also requires the employment of qualified staff with both teaching experience and specialized knowledge in human anatomy [17]. Insufficient dissecting skills among students may lead to a decline in teaching quality in subsequent years, ultimately jeopardizing the education of future physicians and potentially affecting safety and health of patients. Data presented by Ellis [3] corroborate this phenomenon, revealing a sevenfold increase in the number of patient complaints related to medical malpractice due to lack of anatomical knowledge in United Kingdom between 1995 and 2000. This concern is echoed by anatomists and resident physicians, who have expressed their strong objections to teaching anatomy without adequate facilities [11].

The survey results indicate that both physicians and medical students understand the significance of anatomical knowledge for their future professional practice. Respondents of the survey consider practice in the dissection room to be the most effective method of learning the subject, which is consistent with findings from studies by Snelling et al. [19] and Lempp [10]. Pattel and Moxham [15, 15] and Kerby et al. [7] also confirmed that human dissection is the most effective approach to

teaching anatomy. A study by Kalthur et al. [6] highlights that dissection is the most adequate and essential tool in learning human anatomy. The majority of the students participated in that trial pointed that dissection deepens their understanding, provides three-dimensional view and enables quick recall of topics as well as to observe anatomical variations that are of clinical importance.

Public interest in human anatomy has been revitalized by shows and television programs featuring Van Hagen, leading to increased expectations for physicians to possess comprehensive anatomical knowledge. Many in the public actively inquire about anatomical details. Turney [20] reports that an online survey conducted in the United Kingdom revealed that 94% of respondents believed physicians should acquire their anatomical knowledge through direct interaction with preparations and human cadavers. It is crucial that teaching anatomy evolves to adapt to the changing landscape of modern education. However, traditional methods employed in dissection classes remain the most effective means of acquiring practical skills. Survey respondents acknowledged the value of contemporary teaching tools, such as digital anatomical programs, but confirmed that these cannot replace the invaluable experience of working with cadavers.

## CONCLUSIONS

1. A comprehensive understanding of human anatomy is essential for physicians, and practical classes utilizing anatomical preparations and dissections are particularly important.
2. Digital anatomical applications serve as a valuable complement to traditional teaching methods; however, they cannot replace the practical classes conducted in the dissecting room, which allow students to acquire hands-on experience in cadaver preparation.

## ARTICLE INFORMATION AND DECLARATIONS

### Data availability statement

Original contributions presented in the study are included in the article. Further inquiries can be directed to the corresponding author.

## Ethics statement

The project was approved by the Senate Committee on the Ethics of Scientific Research at the Wroclaw University of Health and Sport Sciences No 5/2024.

## Author contributions

Research concept: JF. Material and methods: JF. Implementation of the study: BP, AW. Background: AR-F, DD. Analysis of the results: AR-F. Discussion: JF, MS. Conclusions: JF, MS. References: BP, AW, DD.


## Funding

The authors declare that they have not received any funding.


## Conflict of interest

The authors declare that there is no conflict of interest.

## REFERENCES


1. Anon. The rise and fall of anatomy. BMJ Career Focus. 2005; 330: 255–256.
2. Ellis H. Medico-legal litigation and its links with surgical anatomy. Surgery (Oxford). 2002; 20(8), doi: 10.1383/surg.20.8.0.14518.
3. Ellis H. Teaching in the dissecting room. Clin Anat. 2001; 14(2): 149–151, doi: 10.1002/1098-2353(200103)14:2<149::aid-ca1023>3.0.co;2-u, indexed in Pubmed: 11241750.

4. Goncerz S. Residents against the use of half-measures in teaching anatomy [in Polish]. https://www.mp.pl/kurier/335530,rezydenci-przeciw-stosowaniu-polsrodkow-w-nauczaniu-anatomii (15.11.2024).
5. Heylings DJA. Anatomy 1999-2000: the curriculum, who teaches it and how? Med Educ. 2002; 36(8): 702–710, doi: 10.1046/j.1365-2923.2002.01272.x, indexed in Pubmed: 12191052.
6. Kalthur S, Pandey A, Prabhath S. Benefits and pitfalls of learning anatomy using the dissection module in an indian medical school: A millennial Learner's perspective. Transl Res Anat. 2022; 26: 100159, doi: 10.1016/j.tria.2021.100159.
7. Kaufman MH. Anatomy training for surgeons — a personal viewpoint. J R Coll Surg Edinb. 1997; 42(4): 215–216, indexed in Pubmed: 9276550.
8. Kerby J, Shukur ZN, Shalhoub J. The relationships between learning outcomes and methods of teaching anatomy as perceived by medical students. Clin Anat. 2011; 24(4): 489–497, doi: 10.1002/ca.21059, indexed in Pubmed: 20949485.
9. Korf HW, Wicht H, Snipes RL, et al. The dissection course — necessary and indispensable for teaching anatomy to medical students. Ann Anat. 2008; 190(1): 16–22, doi: 10.1016/j.aanat.2007.10.001, indexed in Pubmed: 18342138.
10. Lempp HK. Perceptions of dissection by students in one medical school: beyond learning about anatomy. A qualitative study. Med Educ. 2005; 39(3): 318–325, doi: 10.1111/j.1365-2929.2005.02095.x, indexed in Pubmed: 15733168.
11. McKeown PP, Heylings DJA, Stevenson M, et al. The impact of curricular change on medical students' knowledge of anatomy. Med Educ. 2003; 37(11): 954–961, doi: 10.1046/j.1365-2923.2003.01670.x, indexed in Pubmed: 14629407.
12. Medpress.pl. Visiting medicine and virtual anatomy. There is a Residents' Agreement position on teaching anatomy [in Polish]. https://www.medexpress.pl/zawody-medyczne/medycyna-turnusow-i-anatomii-wirtualnej-jest-stanowisko-porozumienia-rezydentow-na-temat-nauczania-anatomii/ (15.11.2024).
13. Older J. Anatomy: a must for teaching the next generation. Surgeon. 2004; 2(2): 79–90, doi: 10.1016/s1479-666x(04)80050-7, indexed in Pubmed: 15568432.
14. Patel KM, Moxham BJ. Attitudes of professional anatomists to curricular change. Clin Anat. 2006; 19(2): 132–141, doi: 10.1002/ca.20249, indexed in Pubmed: 16302246.
15. Patel KM, Moxham BJ. The relationships between learning outcomes and methods of teaching anatomy as perceived by professional anatomists. Clin Anat. 2008; 21(2): 182–189, doi: 10.1002/ca.20584, indexed in Pubmed: 18189277.
16. Rainsbury D, Barbour A, Mahadevan V. College launches national anatomy project. Bull R Coll Surg Engl. 2007; 89(1): 19, doi: 10.1308/147363507x166056.
17. Shaffer K. Teaching anatomy in the digital world. N Engl J Med. 2004; 351(13): 1279–1281, doi: 10.1056/NEJMp048100, indexed in Pubmed: 15385652.
18. Singh R, Shane Tubbs R, Gupta K, et al. Is the decline of human anatomy hazardous to medical education/profession? A review. Surg Radiol Anat. 2015; 37(10): 1257–1265, doi: 10.1007/s00276-015-1507-7, indexed in Pubmed: 26092167.

19. Snelling J, Sahai A, Ellis H. Attitudes of medical and dental students to dissection. Clin Anat. 2003; 16(2): 165–172, doi: 10.1002/ca.10113, indexed in Pubmed: 12589673.

20. Turney BW. Anatomy in a modern medical curriculum. Ann R Coll Surg Engl. 2007; 89(2): 104–107, doi: 10.1308/003588407X168244, indexed in Pubmed: 17346399.

21. Waterston SW, Stewart IJ. Survey of clinicians' attitudes to the anatomical teaching and knowledge of medical students. Clin Anat. 2005; 18(5): 380–384, doi: 10.1002/ca.20101, indexed in Pubmed: 15971223.

**Table 1.** Number of participants in each category divided by gender.

| Participants group | Women | | Man | | Together |
|---|---|---|---|---|---|
| | N | % | N | % | |
| Physicians | 67 | 52 | 40 | 31 | 107 |
| Residents and interns | 16 | 13 | 4 | 4 | 20 |
| Students of II–VI years | 444 | 53 | 237 | 29 | 681 |
| I year medical students | 110 | 13 | 44 | 5 | 154 |

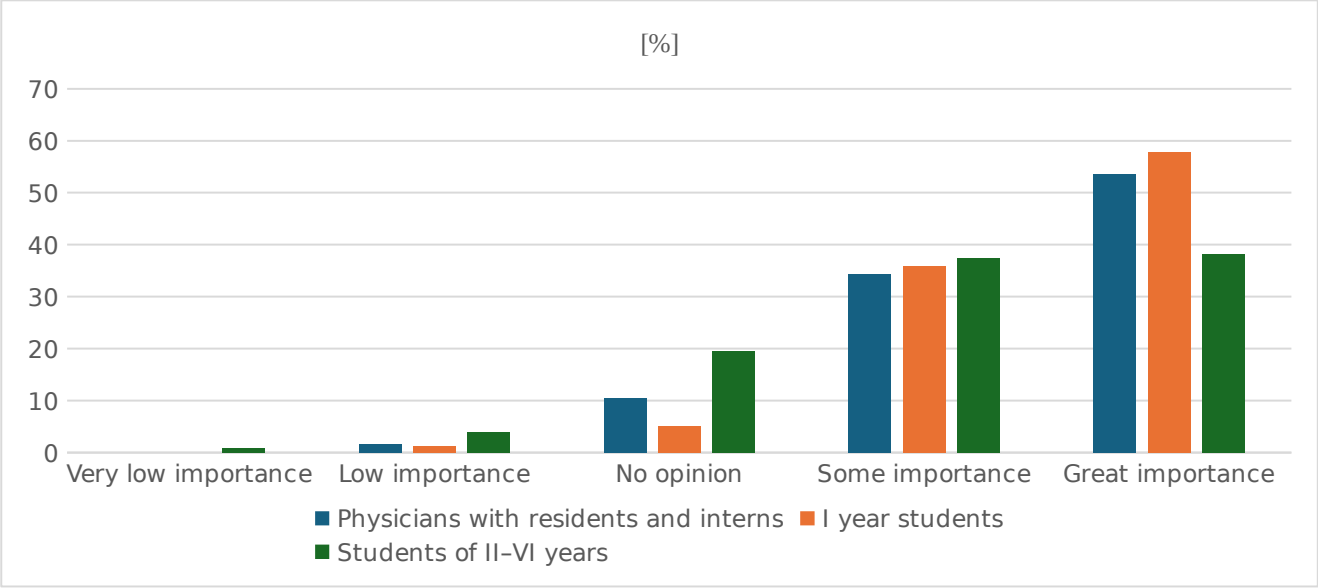

**Figure 1.** Percentage of physicians and students indicating the importance of anatomy in a physician's future work.

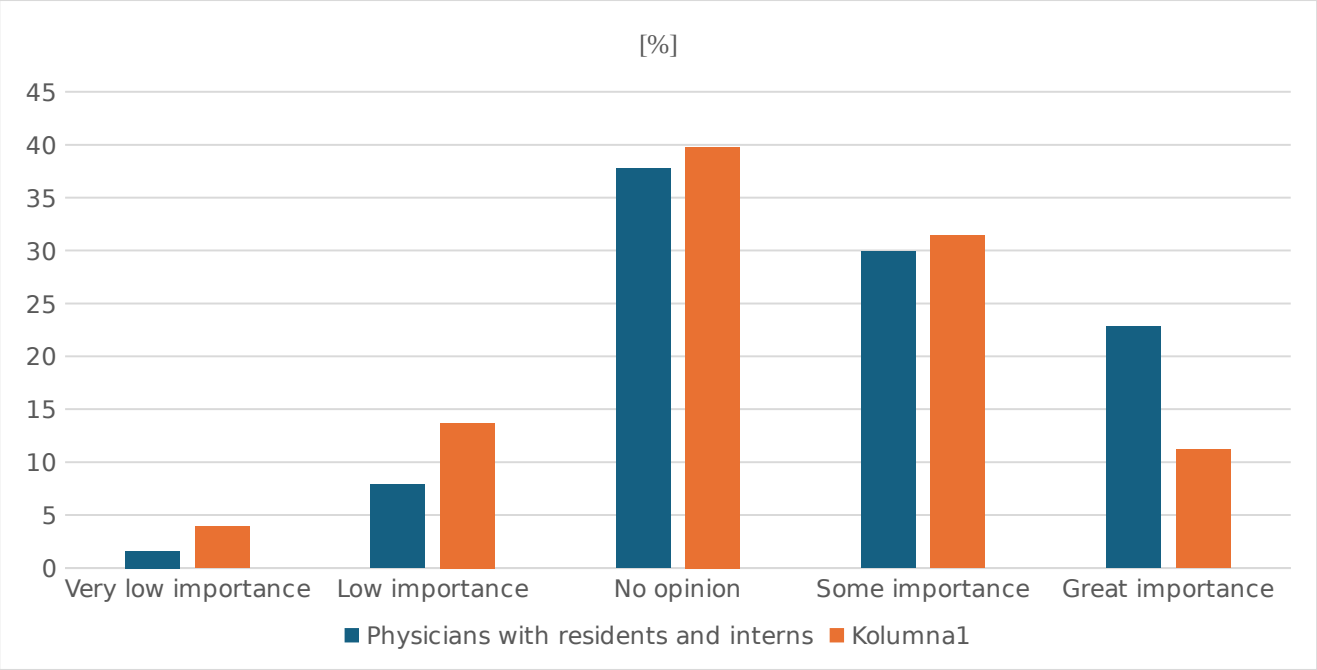


**Figure 2.** Percentage of physicians and students indicating the relevance of anatomical knowledge for other subjects in subsequent years of study.

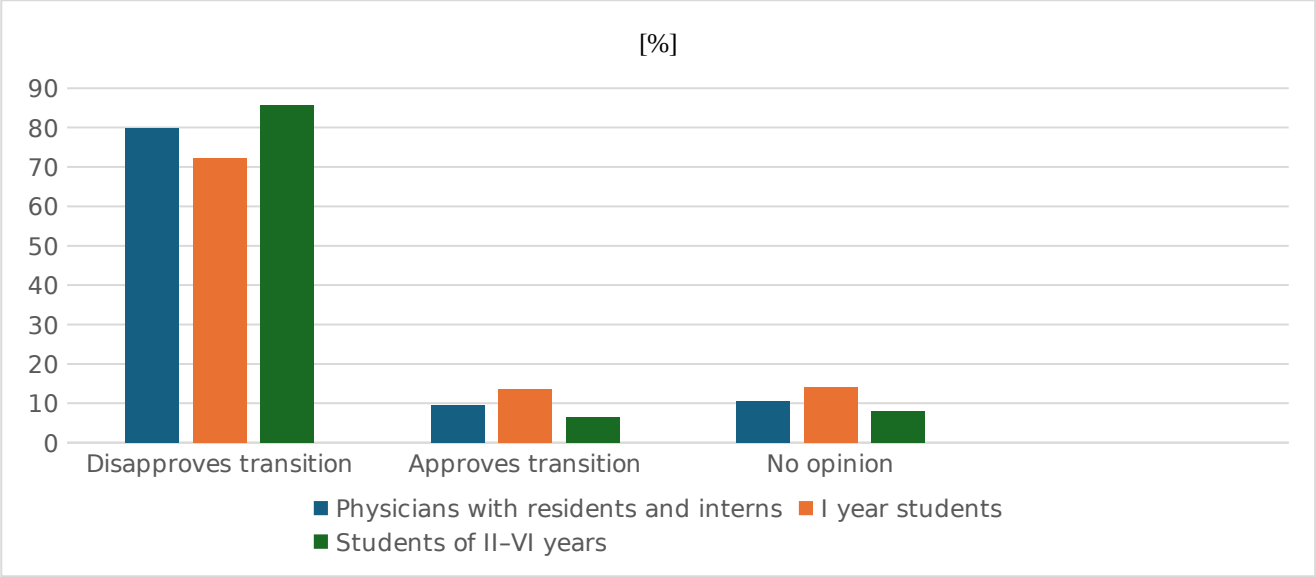


**Figure 3.** Percentage in the groups of physicians and students answering the question whether transition to teaching anatomy without the use of anatomical preparations and cadavers during classes is appropriate.

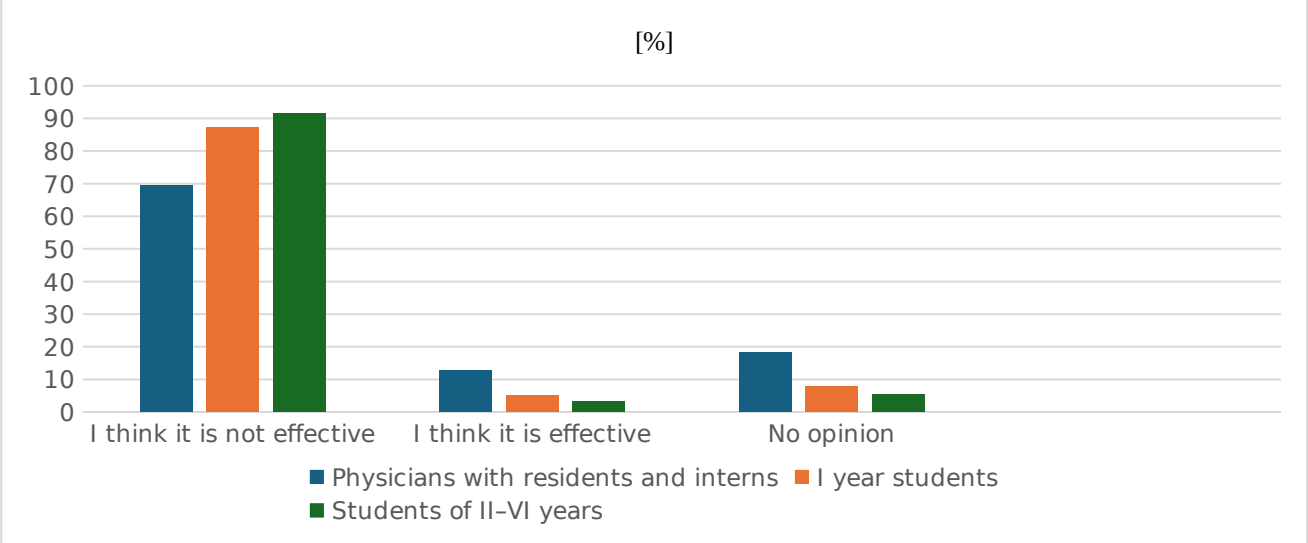


**Figure 4.** Percentage of physicians and students indicating whether digital programs can replace the use of anatomical preparations and cadavers in anatomy classes.

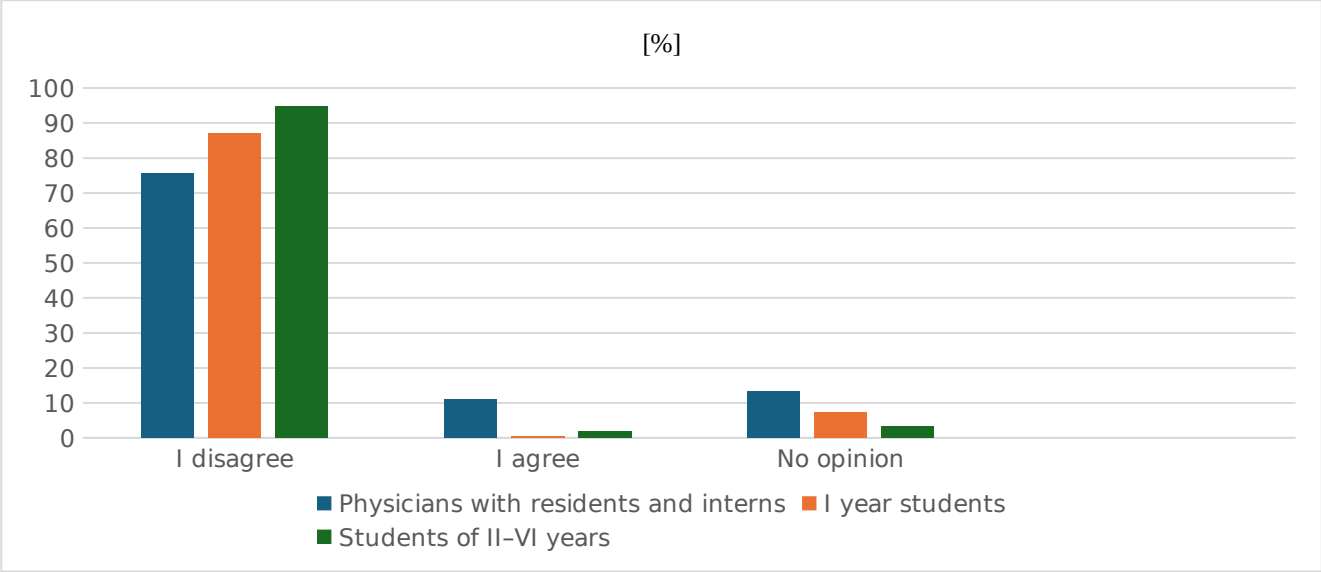


**Figure 5.** Percentage of physicians and students indicating the appropriateness of replacing anatomy classes with multimedia programs instead of using cadavers and anatomical preparations