



NEAR-PEER TEACHING IN ANATOMICAL EDUCATION – OUR OWN EXPERIENCES WITH STUDENTS AS TEACHERS

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Abstract

The anatomical knowledge that students must assimilate is very extensive and necessary to master thoroughly in a relatively short period. To address the difficulties associated with learning anatomy, we decided to preliminarily investigate the method of near-peer teaching (NPT) to improve learning and preparation for exams.

The main aim of our study was to determine students' attitudes toward their own knowledge in the context of being taught by peers. An additional important aspect of the project was to evaluate the significance of this teaching method in the context of effective anatomy learning and to verify the potential for integrating a new form of peer assistance into everyday education.

We initiated a series of lectures conducted by members of our student scientific club to prepare students for their exams. After each lecture, participants were asked to complete a voluntary survey to gather their opinions on their satisfaction with the sessions.

The sessions were rated as helpful by 94.8% of respondents, with 54% stating that the sessions reduced their anxiety before the upcoming exam. However, 26.3% felt that the sessions increased their anxiety. The sessions boosted the self-esteem of 34.7% of respondents and lowered it to 25.4%, while the rest reported no change. As many as 96.1% of respondents would recommend such sessions to other students.

Near-peer teaching appears to be an effective method of supporting the assimilation of material outside of regular classes. The results suggest that NPT can enhance students' self-assessment of their knowledge.

Running title: Near-peer teaching in our experience survey

Keywords: near-peer teaching, anatomy, education, anatomical education

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Introduction

Anatomical education relies strongly on relations between teachers and students. Obviously, in the dissection room, the teacher is critical to showing young adepts of medical sciences anatomical structures [1]. The students must be taught how to handle the anatomical specimens with care and dignity. Also, due to many hardships in mental visualization that need to be performed by the student, the teacher is required to carefully explain the material. Input placed both by teachers and students results in higher standards in later clinical practice [2]. And, undoubtedly, anatomical education is important as anatomy is constantly evolving, with reported anatomical variations growing in numbers [3–6].

Among the important problems of modern anatomical education, there are a few crucial points, and one of them is the decreasing number of competent teachers [7,8]. Anatomy should be known by doctors on a level required at least to treat patients, which hugely differs between specialties [9,10]. Regardless of that, every student must complete a course in human anatomy.

In most schools, anatomy course constitutes a larger part of the first year of studies. In our country, this means that students will study for another five years after they finish the anatomy course. This leaves plenty of time to help out younger students struggling with basic sciences such as anatomy.

This “helping out” process, existing possibly as long as academia itself, was attempted to be standardized and systematized. On that concept, the idea of Near-peer Teaching (NPT) sprouted. NPT means simply students of higher years teaching younger students [11]. While the traditional educational model is still the most popular and, without any doubt, required for the educational process, NPT is becoming more popular every day. NPT as an innovation in medical and, specifically, anatomical education could be a great enhancement among new technologies or, for example, novel techniques that amplify the quality of cadavers [12–14].

We have decided to try ourselves in NPT. For that, as a student scientific club, we decided to create an event in the type of a lecture, which was aimed at familiarizing first-year students with the material required for their test in osteology.

Materials and methods

The survey consisted of 27 questions, including a demographic section of 7 questions and 20 questions about the subject of the study. It was developed using Google Forms and distributed online to first-year medicine and dentistry students at our university who participated in the aforementioned event. The study was conducted in October 2023. All participants have given an informed consent. Data was fully anonymous.

Data from survey was exported from Google Forms as .xlsx file and then edited and sorted using Microsoft Excel. Qualitative data was quantified in the following way:

- For questions with four possible responses, each response was given a specific numerical value from 1 to 4, with 1 being the most negative answer and 4 most positive answer.
- For questions with five possible responses, each response was given a specific numerical value from 1 to 5, with 1 being the most negative answer and 5 most positive answer.

Quantified data was then analyzed using TIBCO Statistica® 13.6.0 software. Using scatter plot analysis, we searched for possible correlations between students’ self-assessment of preparation for the exam and factors that could presumably affect it. We took five different factors into consideration: students’ time spent on learning anatomy weekly, students’ rating of knowledge acquired during anatomy classes, students’ interest in anatomy, time classes were conducted in lecture-style form and time classes were conducted with cadaveric materials. The level of statistical significance was set at $p < 0.05$, correlation was measured with Pearson’s correlation coefficient.

Results

The survey included 91 medical students, of which 67 were women, 23 were men, and one person chose not to answer this question. Seventy-seven respondents were aged 17–19, while the remaining 14 were 20–22 years old. Most respondents were city residents (80.2%), with 19.8% living in rural areas. Most participants (82 students) were medical students, while the remaining 9 were dental students. All respondents were students at the Wrocław Medical University, including 64 studying in Wrocław and 27 in the university’s branch in Walbrzych. The vast majority (91.2%) had not previously attended anatomy classes due to studying in different fields, and for 81.3% of them, the exam preparation, which was the “Anatomy Review,” was their first academic test of knowledge during normal anatomy. The review was conducted both in-person and online. Seventy-eight participants attended the in-person review, while the remaining 13 participated online.

Assessing their level of preparation for the anatomy exam, 42.9% felt moderately prepared, 28.6% poorly prepared, 20.9% well prepared, 5.5% very poorly prepared, and two people rated their preparation level as very good.

Considering the amount of knowledge gained from the anatomy classes, 54.9% of respondents gained a large amount of knowledge, 22% a moderate amount, 13.2% a very large amount, 6.6% a small amount, and the remaining 3.3% assessed

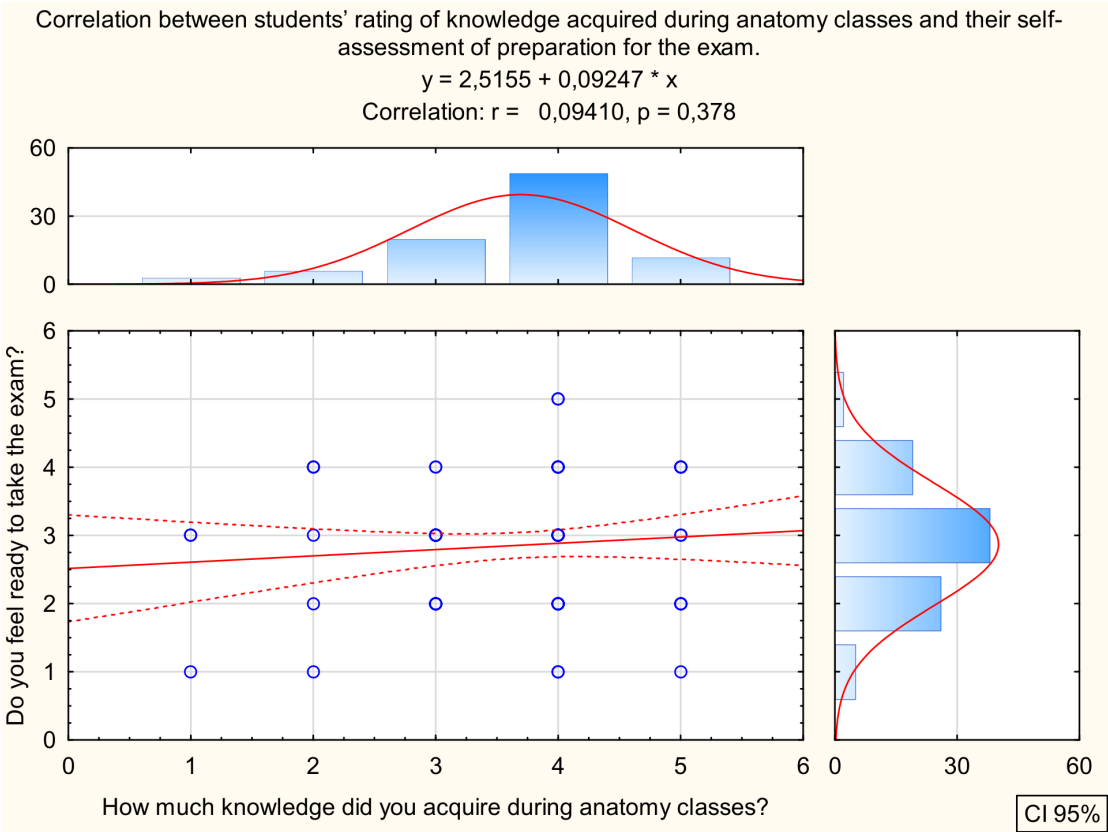


FIGURE 1 Scatter plot analysis showing correlation between students' time spent on learning anatomy weekly and their self-assessment of preparation for the exam. Statistical analysis shown statistically significant correlation with $p = 0,0209$ and very weak correlation with $r = 0,24511$

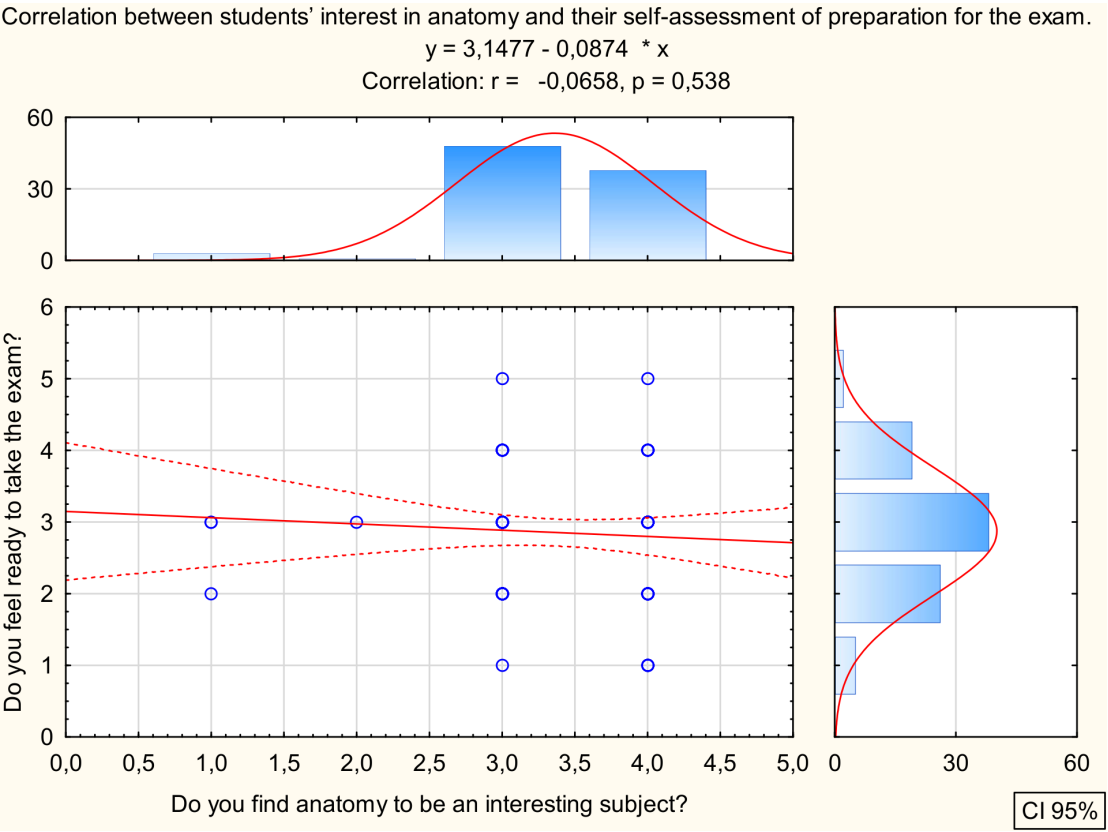


FIGURE 2 Scatter plot analysis showing correlation between students' rating of knowledge acquired during anatomy classes and their self-assessment of preparation for the exam. Statistical analysis shown statistically insignificant correlation with $p = 0,3721$

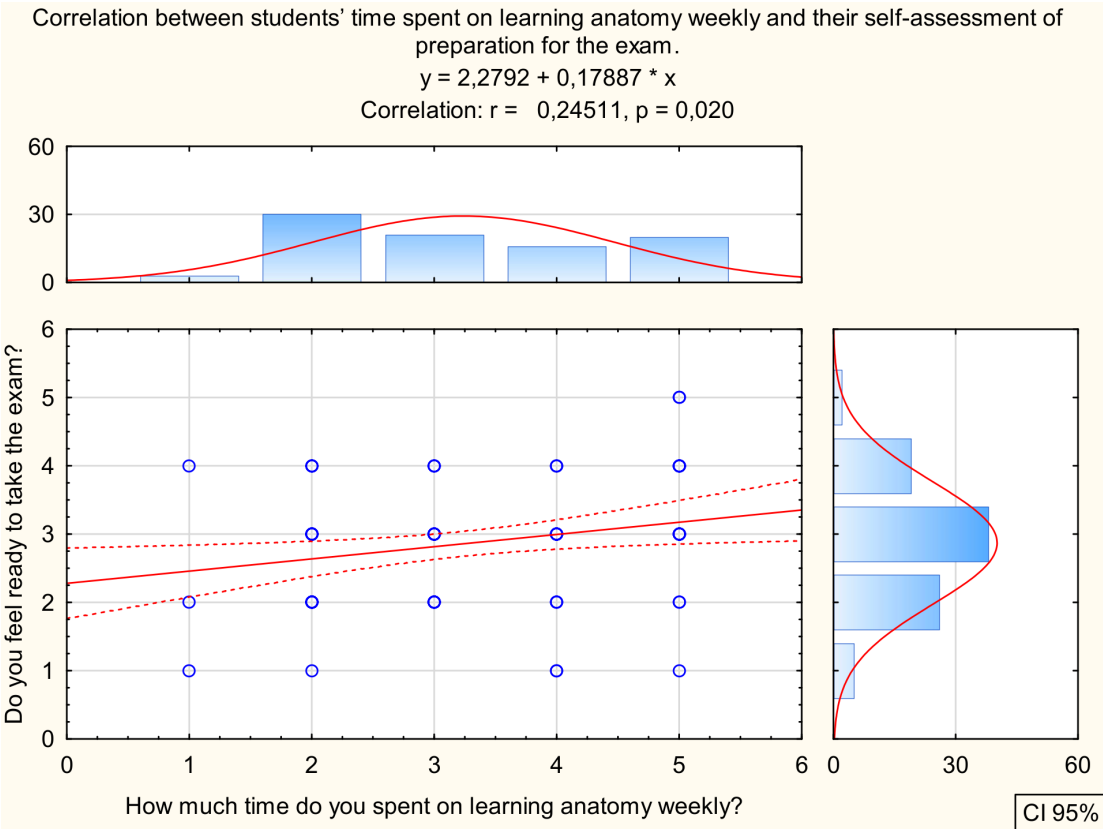


FIGURE 3 Scatter plot analysis showing correlation between students' interest in anatomy and their self-assessment of preparation for the exam. Statistical analysis shown statistically insignificant correlation with $p = 0,5306$

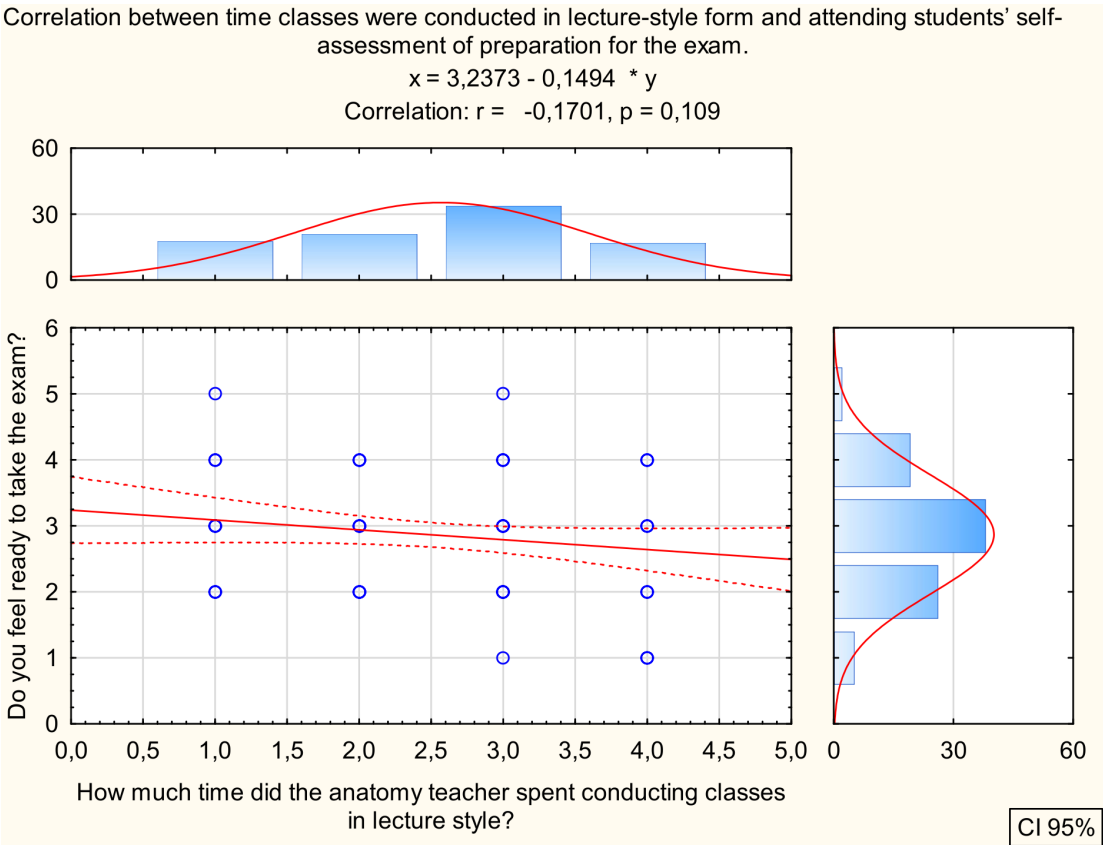


FIGURE 4 Scatter plot analysis showing correlation between time classes were conducted in lecture-style form and attending students' self-assessment of preparation for the exam. Statistical analysis shown statistically insignificant correlation with $p = 0,1089$

the amount of knowledge gained as very small. Statistical analysis showed no statistically significant correlation between students' rating of knowledge acquired during anatomy classes and their self-assessment of preparation for the exam with $p = 0,378$ (**Fig. 1**). 53.8% of surveyed students rated anatomy as an interesting academic subject, 41.8% as very interesting, 3.3% as very uninteresting, and one person rated anatomy as uninteresting. Statistical analysis showed no statistically significant correlation between students' interest in anatomy and their self-assessment of preparation for the exam with $p = 0,538$ (**Fig. 2**). When asked about the amount of time spent weekly studying for the anatomy exam, 34.1% of them spent 5-10 hours, 23.1% spent 11-15 hours, 22% more than 20 hours, 17.6% 16-20 hours, and 3.3% 1-4 hours. Statistical analysis showed statistically significant very weak correlation between students' time spent on learning anatomy weekly and their self-assessment of preparation for the exam with $p = 0,020$ and $r = 0,24511$ (**Fig. 3**). Evaluating the portion of the class time the instructor spent explaining topics using theoretical sources (textbooks, multimedia presentations, etc.), for 37.8% of respondents, it was $\frac{1}{2}$ - $\frac{3}{4}$ of the class time, for 23.3%, it was $\frac{1}{4}$ - $\frac{1}{2}$ of the time, 20% less than $\frac{1}{4}$ of the time, and for the remaining 18.9%, it was more than $\frac{3}{4}$ of the class time. Statistical analysis showed no statistically significant

correlation between time classes were conducted in lecture-style form and attending students' self-assessment of preparation for the exam with $p = 0,109$ (**Fig. 4**). 31.1% of respondents answered that the instructor spent $\frac{1}{4}$ - $\frac{1}{2}$ of the class time explaining topics using available specimens, another 31.1% less than $\frac{1}{4}$ of the class time, 21.1% $\frac{1}{2}$ - $\frac{3}{4}$ of the class time, and the rest (16.7%) had access to specimens for more than $\frac{3}{4}$ of the class time. Statistical analysis showed statistically significant very weak correlation between time classes were conducted with cadaveric materials and attending students' self-assessment of preparation for the exam with $p = 0,045$ and $r = 0,21162$ (**Fig. 5**).

Auxiliary materials used by students during their exam preparations were also analyzed. 85.7% of respondents used flashcards (Anki, Quizlet), 75.8% read textbooks, 34.1% studied with friends, another 34.1% used mnemonic techniques, 44% studied from their notes, 9.9% watched lectures, 18.7% watched materials by online creators, 9.9% used the Feynman technique, and the remaining 7.7% used methods such as materials collected by senior students, watching anatomical atlases, apps, etc. 45.6% of those surveyed, when asked about study techniques used during preparations for the theoretical part of the exam, responded that they used flashcards, 93.3% focused on reading textbooks, 38.9% studied with friends, 25.6% used mnemonic

Correlation between time classes were conducted with cadaveric materials and attending students' self-assessment of preparation for the exam.

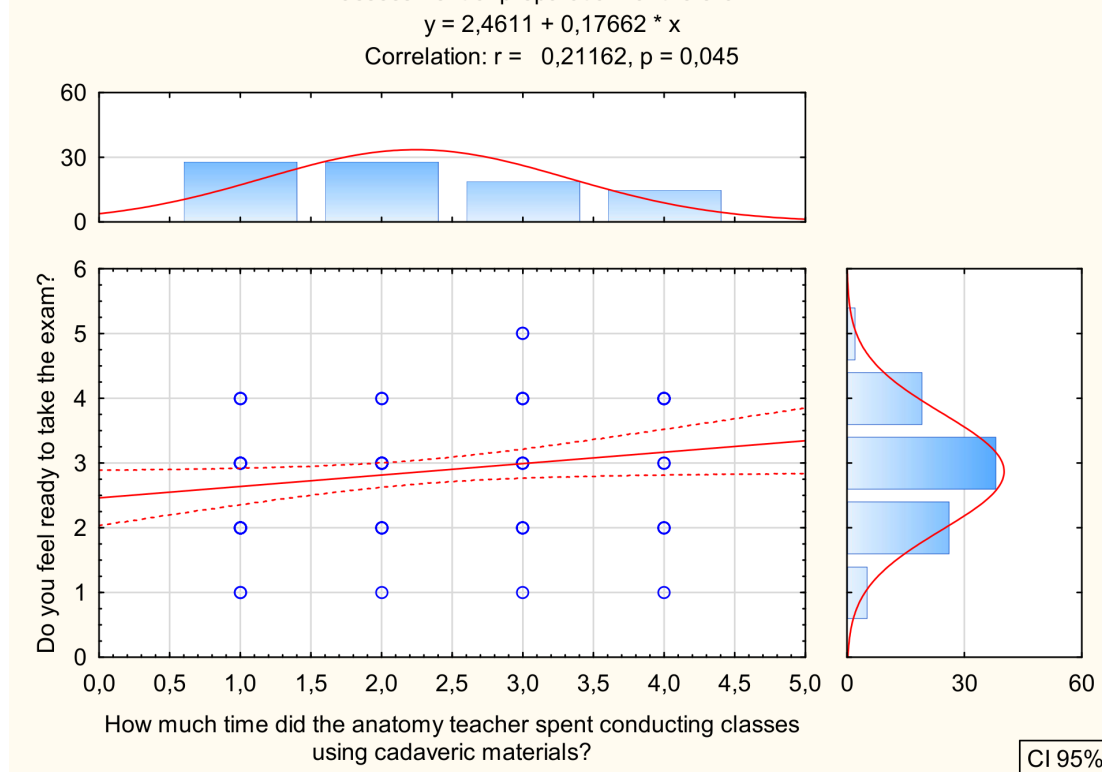


FIGURE 5 Scatter plot analysis showing correlation between time classes were conducted with cadaveric materials and attending students' self-assessment of preparation for the exam. Statistical analysis shown statistically significant correlation with $p = 0,0453$ and very weak correlation with $r = 0,21162$

techniques, 52.2% made their notes, 12.2% watched online creators, and the remaining 17.8% watched lectures. In our survey, we also focused on analyzing students' expectations towards the "Anatomy Review." 51.6% of them expected to learn a lot, 37.4% had no expectations, 5.5% hoped to learn a great deal, and the remaining 5.5% thought they would learn little. 61.5% of respondents believed that the review would be rather helpful, 28.6% thought it would be very helpful, 8.8% had no opinion on the matter, and one person believed the review would not be helpful for them. When asked about feelings of anxiety related to the exam, 40.7% responded that they rather felt anxiety, 34.1% were very afraid, 12.1% had no opinion, 11% did not feel anxiety, and two people did not feel anxiety at all. Respondents also assessed their knowledge status before the "Review." 46.2% rated it as neutral, 26.4% as good, 22% as bad, three people rated it as very bad, and two as very good. After the lecture addressed the most important aspects for the respondents, we asked them for an overall assessment of the event. 52.7% of them were satisfied with the classes, 39.6% were very satisfied, 5.5% had no opinion, and the remaining two people were very dissatisfied. The "Anatomy Review" met the expectations of 49.5% of respondents, 26.4% rated it as better than expected, 22% rated it as much better than expected, and the remaining two people rated it as worse than expected. For 50.5% of students, the "Review" was rather helpful, for 44%, it was very helpful; 4.4% had no opinion, and for one person, it was rather not helpful. When asked whether the "Anatomy Review" changed their level of anxiety related to the upcoming exam, 45.1% responded that it slightly decreased anxiety, 23.1% felt no change in attitude, 18.7% responded that stress/anxiety slightly increased, 7.7% felt that stress significantly increased, and for the remaining 5.5%, stress significantly decreased. For 42.2% of students, the "Review" did not change their self-assessment of knowledge status; 28.9% noted that their self-assessment level slightly increased after the classes, for 17.8%, it slightly decreased, for 5.6%, it significantly decreased, and for remaining 5.6% it significantly increased before the exam. When asked if they would recommend others to participate in the "Anatomy Review," 60.4% would, 35.2% rather would, and the remaining 4.4% had no opinion.

The classes were rated as helpful by 94.8% of respondents; 54% believed that they reduced their level of anxiety before the upcoming exam, but 26.3% thought that the classes increased their anxiety level. The classes increased self-assessment according to 34.7% of respondents but decreased it according to 25.4%, with the rest seeing no change in self-assessment. As many as 96.1% of respondents would recommend such classes to other students.

Discussion

The findings of this study highlight the potential of Near-peer Teaching (NPT) as a possible extension of traditional anatomy education. By involving senior students in teaching first-year medical and dentistry students, we may enhance the educational prowess of the young adepts of the science and art of medicine. The "Anatomy Review" demonstrated positive outcomes, particularly in improving students' perceptions of their knowledge and preparation for exams and alleviating anxiety related to upcoming tests. Additionally, NPT facilitates peer-to-peer communication, often making complex material more relatable and accessible.

A significant percentage of participants (94.8%) found the review helpful, with most respondents noting it met or exceeded their expectations. However, it is worth noting that the impact of the review on students' anxiety was mixed. At the same time, 54% reported reduced anxiety levels, and 26.3% experienced increased stress. Self-assessment outcomes similarly pose a dichotomy: while many participants reported improved confidence, some experienced a decline, potentially reflecting heightened awareness of knowledge gaps.

Importantly, the high recommendation rate (96.1%) indicates strong satisfaction with the format and utility of the event. The use of diverse learning methods, such as flashcards and multimedia resources, alongside hands-on exposure to anatomical specimens, likely contributed to its effectiveness. These results suggest NPT to be an interesting direction for growth. Given the growing scarcity of qualified anatomy instructors, NPT represents a student-driven alternative.

Given that, as statistical analysis showed, in-class learning and self-education have very weak or no statistically significant correlation with students' self-assessment of preparation for the exam, near-peer teaching may be a good supplementary method for acquiring knowledge essential for the medicine students.

Conclusions

No statistically significant correlation with students' self-assessment of preparation for the exam was found between three out of five examined factors – students' rating of knowledge acquired during anatomy classes, interest in anatomy and time classes were conducted in lecture-style form. For the rest of the factors – students' time spent on learning anatomy weekly and time classes were conducted with cadaveric materials, we found very weak, statistically significant correlation.

A significant proportion of participants (94.8%) found the review helpful. This shows the efficacy of NPT in creating a supportive learning environment. The variability of the results suggests that although NPT can be beneficial, it may not fully address the

challenges of anatomy learning. The summary from the survey leads us to conclude that peer teaching positively influences students' attitudes toward learning anatomy and, in the vast majority of cases, allows them to reduce stress/anxiety before taking exams. This method of learning develops competencies and skills and demonstrates significant support among students, as well as the potential to expand the spectrum of learning methods.

Future studies could explore long-term effects, such as knowledge retention, assessment by resident supervisors, and clinical practice assessment, to further validate its impact. We suggest running studies on larger groups and longitudinal studies observing the students through the whole anatomy course.

Ethical approval

The conducted research is not related to either human or animal use.

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Conflict of interest statement

The authors declare no conflict of interest.

References

- Lieu RM, Gutierrez A, Shaffer JF, Bs AG. Student perceived difficulties in learning organ systems in an Undergraduate Human Anatomy Course. *HAPS Educator*. 2018;22(1):84–92; DOI:10.21692/haps.2018.011.
- Smith CF, Mathias HS. What impact does anatomy education have on clinical practice? *Clin Anat*. 2011;24(1):113–9; DOI:10.1002/ca.21065.
- Mazurek M, Pioterek O, Drążyk M, Pozdnyakova D, Kozłowski O, Tarkowski V, Wanat M, Nowak B, Domagała Z. An atypical obturator nerve: an anatomical and clinical case report. *Med. J. Cell Biol*. 2023;11(2):55–9; DOI:10.2478/acb-2023-0009.
- Mazurek M, Pioterek O, Drążyk M, Pozdnyakova D, Kozłowski O, Tarkowski V, Domański J, Domagała Z. Decoding the mysteries of the obturator nerve. *J Anat Soc India*. 2024;73(1):64–9; DOI:10.4103/jasi.jasi_122_23.
- M, Pioterek O, Drążyk M, Wanat M, Kozłowski O, Domagała Z. Unusual pattern of branches and ganglions of cervical sympathetic trunk- single case study with clinical implications. *Med. J. Cell Biol*. 2023;11(2):50–4; DOI:10.2478/acb-2023-0008.
- Dworski K, Mazurek M, Domański J. Posterior superior alveolar artery – an anatomical and clinical case report. *Med. J. Cell Biol*. 2023;11(3):93–7; DOI:10.2478/acb-2023-0016.
- Bergman EM, Prince KJAH, Drukker J, der Vleuten CPM Van, Scherpbier AJJA. How much anatomy is enough? *Anat Sci Educ*. 2008;1(4):184–8; DOI:10.1002/ase.35.
- Wilhelmsson N, Dahlgren LO, Hult H, Scheja M, Lonka K, Josephson A. The anatomy of learning anatomy. *Adv Health Sci Educ Theory Pract*. 2010;15(2):153–65; DOI: 10.1007/s10459-009-9171-5.
- Rehman U, Perwaiz I, Sarwar MS, Brennan PA. Are clinical medical students confident about their head and neck anatomy knowledge? *Br J Oral Maxillofac Surg*. 2022;60(7):922–6; DOI:10.1016/j.bjoms.2022.01.015.
- Arráez-Aybar LA, Sánchez-Montesinos I, Mirapeix RM, Mompeo-Corredera B, Sañudo-Tejero JR. Relevance of human anatomy in daily clinical practice. *Ann Anat*. 2010;192(6):341–8; DOI:10.1016/j.aanat.2010.05.002.
- Evans DJR, Cuffe T. Near-peer teaching in anatomy: An approach for deeper learning. *Anat Sci Educ*. 2009;2(5):227–33; DOI:10.1016/j.aanat.2010.05.002.
- Domagała ZA, Drążyk M, Pioterek O, Kozłowski O, Lubieniecki P, Sroczyński M, Dudek A, Woźniak S, Tarkowski V, Mazurek M. Precision in preservation: mastering cadaver embalming with the femoral artery approach – a technical note. *Folia Morphol (Warsz)* [Internet]. 2024 [cited 2024 Nov 12]. Epub 2024 Jul 22. Available from:10.5603/fm.99260.
- Jankiewicz J, Mazurek M, Gajda-Janiak A, Pioterek O, Drążyk M, Tuluski M, Domański J, Domagała Z. Can we make anatomical specimen last forever? Technical note on photogrammetry. *Med. J. Cell Biol*. 2023;11(4):108–13; DOI:10.2478/acb-2023-0018.
- Domagała ZA, Mazurek M, Kozłowski O, Drążyk M, Tarkowski V, Domański J, Dąbrowski P, Woźniak S. Challenges associated with vascular access through the common carotid artery during embalming procedures in humans: a technical note. *Folia Morphol (Warsz)*. 2024;83(2):360–6; DOI:10.5603/fm.95539.