

Students' Perception Regarding the Use of Artificial Anatomic Models

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Abstract: Introduction: Historically, the teaching of anatomy uses human cadavers. However, artificial pieces have been gaining ground in the teaching methodology. Objective: To analyze the students' perception regarding anatomy study using artificial anatomical models through a structured instrument. Method: Application of a structured questionnaire to 222 health areas students in two teaching institutions from Juiz de Fora-MG-Brazil. The students should have already taken the discipline of Anatomy. Data collection was carried out at the colleges, tabulated in an Excel spreadsheet, and proceeded with statistical analyses. Results: Students were mainly in the 18-19 age group (42%); they considered that artificial pieces facilitate learning (about 80%); they were confident about the use of anatomic knowledge in clinical practice (80%). Most of them (81%) said that learning with artificial models was excellent or good despite considering a large number of structures to be memorized as a difficulty (83%). Conclusion: Respondents used synthetic parts on a large scale and attributed a superb quality to teaching/learning using these materials. They believed, in general, in their excellent preparation for applying anatomical knowledge in professional life.

Keywords: Anatomy, Medical Education, Artificial Anatomical Models

1. Introduction

Human anatomy occupies a prominent place among the oldest medical sciences, and this maxim is unanimous among authors and researchers [1-5], who also emphasize its importance-complexity as a discipline.

In the anatomy study, the student is directed to early and necessary contact with professional reality, allowing an insight into applying theoretical-practical knowledge in his life after graduation [6]. And for Collipal [7], the discussion study, although essential for all courses in the health area arouses great curiosity and is a challenge to the teaching and learning methods. What makes it vital to have a close link between teachers and students is content and approach, as Montes [8] also defends.

"Anatomy," in an etymological sense, means "to cut into parts." Still, as Jones [9] discussed, an anatomical study is no

longer limited to dissecting corpses, and most higher education institutions use artificial models in anatomy classes.

According to Collipal [7], these new educational trends in Anatomy have been gaining strength, motivated by several factors such as the difficulty in obtaining cadavers, the excellent quality of synthetic anatomical features available on the market, and the high costs of preparation and maintenance of an anatomy laboratory. Soon, the path points towards incorporating artificial anatomical elements in the didactic support.

3D images (computational anatomy), Anatomy-specific videos, and software are other essential tools available to support the teaching of the human body in colleges and universities [3, 4].

However, artificial anatomical parts constitute an irreversible reality. Therefore, these are being widely used, more and more, in higher education institutions with courses in the Health Area, facilitating access to contact with

anatomical science, and reducing the difficulty that involves the preparation and maintenance of a laboratory containing cadaveric parts [2].

Penha [5] raises poignant doubts built on the effectiveness of these teaching methods to the detriment of the use of cadavers, just as Inzunza [10] questioned how the Student sees his learning when using these synthetic models, and even asked what the impact of these on the teaching and learning process in a medical school is.

Regarding these questions, the objective of this study emerged: to evaluate the Student's perception in their journey in anatomy laboratories using artificial models. The work's target audience was students in a private school and a public university from Juiz de Fora-MG- Brazil.

2. Methodology

This paper is a cross-sectional study in which data from a structured questionnaire (Survey type) composed of closed questions, previously established, capable of identifying the students' assessment, were evaluated. About 222 health areas' course students answered the instrument, all from two faculties in Juiz de Fora, MG-Brazil. Systematic script-based parameters, considering the demographic variables of an anamnesis: sex; age; marital status, and which course the interviewee belonged to, in addition to the temporal relationship with the practical teaching of anatomy, that is, if they were still studying the subject or if they had already completed their study. The interviewees also questioned the students about which materials were used in their anatomical practices, which methods facilitate the teaching-learning process in anatomy learning, and what factors make this process complex. Moreover finally, their confidence in their anatomical knowledge and opinions regarding learning using artificial anatomical pieces.

Among the 222 subjects, there were students in Nursing, Pharmacy, Physiotherapy, Medicine, and Dentistry courses. The researchers excluded the Students who did not have experiences (for some reason, such as transferring from an institution, for example) with artificial anatomical parts.

The research was approved by the Research Ethics Committee of the Faculdade de Ciências Médicas e da Saúde of Juiz de Fora-SUPREMA under protocol number 3,450,088.

The application of questionnaires was between August 2019 and December 2019. Data were tabulated in an Excel spreadsheet, version 16.0, and processed using the SPSS program, version 20.0 (Chicago, IL, USA). The mean \pm standard deviation (SD) represented the results for numerical variables and absolute and relative frequency for categorical variables. The applied statistical tests were: the Chi-square and the Student's "t" test. Statistical significance was set at $P < 0.05$.

3. Results

Of the participants, 76% were female, and the remaining 24% were male (percentages rounded to the nearest magnitude for simplicity). About 42% ($n=94$) were between

18 and 19 years old; 105 (47%) were between 20 and 24 years old, and ten students (4.5%) were 25 years old or older. The rest were 17 years old.

Responding to the topic "Factors that make it difficult to learn anatomy," 82% ($n=185$) pointed out many structures and names to memorize. In comparison, 15% ($n=37$) said that lecture-only classes were a problematic factor.

Asked to assign a grade (between excellent, good, fair, and bad) to their anatomy learning, 103 students (48.5%) considered the course good; 83 (37%) classified it as excellent; 36 (16%) Regular and only 1 (about 0.5%) qualified as insufficient.

The student's confidence regarding the learning achieved shows that 80% of the students are confident in the anatomical basis they had for clinical practice, without considering the greater or lesser contact with artificial parts in this process. In comparison, 20% of these students did not have the same confidence.

Figure 1 shows the teaching materials - other than cadaveric pieces - most used in the anatomy study. By the academics interviewed, students could select more than one answer option in the questionnaire. However, some highlights were evident, such as Textbooks with 86% and Teacher slides with 80%, the teaching materials most used by students.

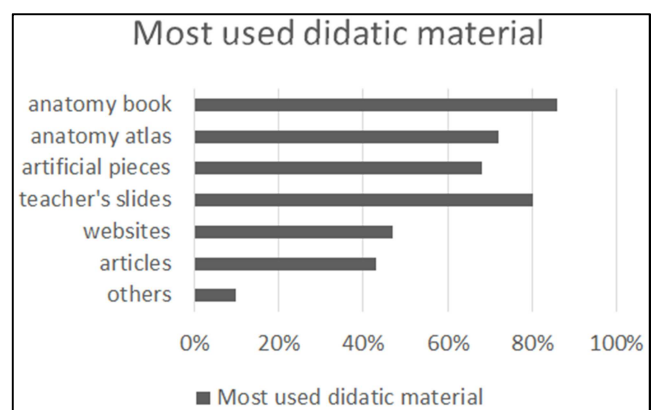


Figure 1. Graph showing the didactic material most used by academics.

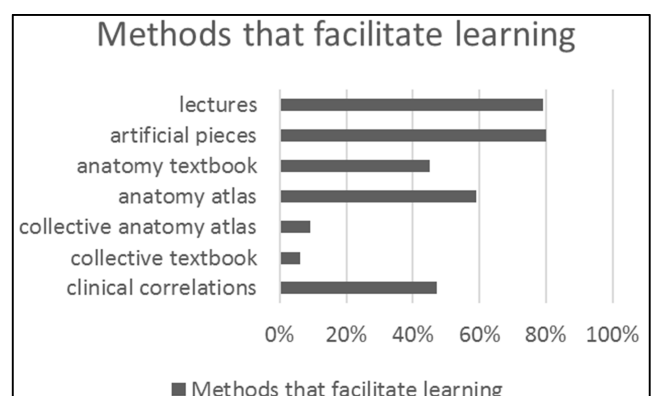


Figure 2. Graph showing the percentages referring to methods that facilitate the teaching-learning process in anatomy.

Figure 2 shows the perception of the methods that facilitate the teaching-learning model in anatomy, according to the

students interviewed. For example, they could select More than one answer option, and artificial anatomical pieces were essential in 80% of cases.

Figure 3 shows the opinion of the academics who used artificial pieces regarding the quality of their learning process: Good for 48% (n=107) and excellent for 37% (n=82).

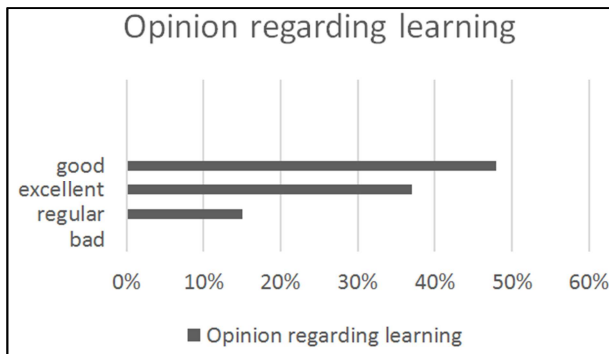


Figure 3. According to students, a graph shows opinions regarding the quality of learning using artificial parts.

The grades exposed in Figure 4 quantize, increasingly and proportionally from 0 to 10, the satisfaction with the study in artificial anatomical pieces, and the academics assigned. Grade 8 was the most recurrent, with 24.8% (n=55), and grade 10 appeared with 20.7% (46).

After being tabulated, the data underwent statistical

treatment to assess their reliability and statistical significance. In addition, were performed crossings between some data (we keep the values here with rounding):

1) Study material used X Academic confidence regarding the learning achieved in applying knowledge in the clinic.

This correlation was not statistically significant ($p=7.7$). Still, it is notorious that of the 80% (n=178) who declared the studies on artificial pieces as positive, around 65% (n=115) recognized that there was confidence in this part by using their anatomical knowledge in the clinic. By pointing out the textbook as a frequently used material (85%, n=189), 93% of this universe (n=176) consider themselves to have satisfactory confidence levels. Among the students who also used the anatomy atlas for study, 72% (n= 160) and only 35 (21.9%) considered themselves insecure in the clinical application of their knowledge.

2) Factors that make it challenging to learn X concepts about the general teaching of anatomy with artificial parts.

The statistical significance here was striking $p=0.03$. It was possible to infer that 44% (n=80) of the universe of respondents who pointed out many structures to memorize considered the study with artificial models to be excellent. In the same way, of the 33 individuals, or almost 16% of the total, who assumed the teaching/learning process with synthetic pieces to be regular, 29 (74% of this group) defined lectures as a hindering factor in learning (Table 1).

Table 1. Correlation between variables: Opinion regarding the learning with artificial parts X Factor makes the anatomy learning process more difficult. $P=0.035$.

Factors that make learning difficult	Opinion regarding learning				Total of options
	Excellent	Good	Reasonable	Bad	
	(% between the total number of students)				
A large number of structures to be memorized	n=80 44,0% (36%)	n=101 55,5,0% (45,5%)	n=4 0,5% (1,5%)	n=0 0,0% (0,0%)	n=185 100,0% (83%)
Overly expository classes	n=2 5,5% (0,9%)	n=6 20,5% (2,8%)	n=29 74,0% (13,3%)	n=0 0,0% (0,0%)	n=37 100,0% (17%)

3) Grade is given to the study/learning with artificial parts X Confidence in applying knowledge in clinical practice.

Table 2. Correlation between the variables: Grade attributed to the study/learning with artificial pieces X student confidence in applying anatomy in clinical practice ($p= 0.222$).

Note attributed to the study with the artificial pieces	Confidence in the application of anatomy in clinical practice		
	Yes- n (%) [% of total students]	No- n (%) [% of total students]	Total- n(%) [% of total students]
Grade 4	n= 2 (100%) [0,9%]	n= 0 (0,0%) [0,0%]	n=0 (0,0%) [0,9%]
Grade 5	n=11 (79,0%) [5,0%]	n=3 (21,5%) [1,5%]	n=14 (100%) [6,5%]
Grade 6	n=19 (68,0%) [8,5%]	n=9 (3,0%) [4,0%]	n=28 (100,0%) [12,5%]
Grade 7	n=32 (67,0%) [14,5%]	n=16 (33,0%) [7,0%]	n=48 (100,0%) [21,6%]
Grade 8	n=48 (87,0%) [21,5%]	n=7 (13,0%) [4,0%]	n=55 (100,0%) [24,8%]
Grade 9	n=25 (86,0%) [11,3%]	n=4 (18,0%) [1,8%]	n=29 (100,0%) [13,1%]
Grade 10	n=37 (80,5%) [21,3%]	n=9 (19,5%) [18,2%]	n=46 (100,0%) [20,7%]

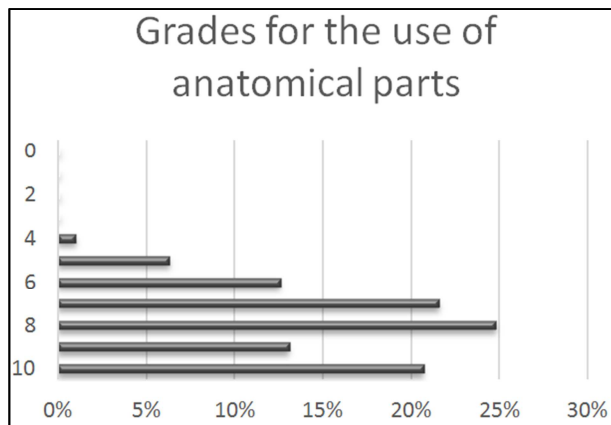


Figure 4. Graph showing grades about the satisfaction with studying anatomy using artificial parts.

Table 2 shows the statistical correlation; whose significance was $p=0.222$. Although of the 48 students (21.6% of the total), who attributed the grade 8 to the study with the artificial pieces, 32 (67% of the group), which would correspond to 10.9% of the total interviewees, did not consider that they will have difficulties in clinical practice vis-à-vis the use of synthetic models. In the universe of grades equal to or less than 6, attributed by 24 students (10.8% of the amount), it was possible to detect that 78.6% ($n=19$) of them did not consider having clinical difficulties in the future.

4. Discussion

To the detriment of its unique importance in the training of health professionals, Anatomy is undoubtedly one of the most complex subjects seen at the beginning of all courses. The reality of entering university education at a young age of students when starting the practice can contribute to this difficulty. Mostly marked the data that shows the challenge of an anatomy course for 82% ($n=185$) of the students interviewed in this research pointed out as a factor that hinders the learning of anatomy, a large number of structures and names for memorizing, a situation corroborated by research by Reis [11] and Salbego [6].

When we associate the variable "opinion regarding learning" with the most incredible difficulty in studying the subject, we see that despite a large number of structures to be memorized, more than 90% of the students still rank the course as "excellent" or "good.". Although this correlation was not statistically significant, Venâncio [4] corroborates, in his research, this good assessment of the Anatomy study in the opposite direction to what Reis [11] found.

Martinelli [12] reported that his investigation showed that 50 and 75% of the students involved in his research advocated that teachers work using slides to fix content. Impressive was the evidence pointed out as "study material" by the interviewees in our work. Even if textbooks use is related to standard practice for 86% of the subjects, about 80% reported using the teacher's slides as the primary tool in this sense. Reis [11] obtained a different result in his research that showed a

preference for slides, shared by approximately 37% of his researched audience. However, the author reports that almost 50% of those interviewed declared they never resorted to an anatomic scientific article. As well as the anatomical atlases, the textbook and scientific articles make up the pillars of good discipline study with the practical class pieces.

Even without statistical significance, the confidence of academics regarding the learning achieved faces the positive evaluation of their growth as a student of Anatomy. Data was proportional to this confidence in the clinical application of what was studied. However, Martinelli [12] warns in his study that, being Anatomy taught in the first year of graduation, with an often excessive amount of irrelevant material for a given course, it may not allow the Student to understand the importance of structures in their future professional practice.

Penha [5] considers it ordinary in health courses to use artificial parts to compensate for the scarcity of study corpses. And the referring research showed that the students asked whether the contact with the pieces of the corpse met their expectations, about 65% said they "agreed" or "strongly agreed," whereas, concerning the models' synthetics, this agreement was almost 80%.

In the present investigation, in our data on artificial pieces, it was clear that 68% of respondents reported that this method/study material was one of the most used. According to 80%, such pieces facilitate learning, directly corroborating Penha (2020). Costa [13] explains that much of this preference for artificial anatomical models is due to the negative impact that the corpse can have on students in an anatomy laboratory. These issues, supported by Biswas [14] and Jones [9], also add that the aggressive action of the means of preserving corpses in the airways (formalin, for example) can worsen the situation.

Pina [15] states that according to the results obtained in her investigation, synthetic pieces suggest a better use of students when compared to cadaveric ones. In our investigation, approximately 80% of the students rated 7, 8, 9, and 10 for the study with the artificial models. And when associated with this perception of eventual confidence in anatomical knowledge used in professional life, the tendency that the higher grades attributed to the study with the artificial pieces were, in a way, linked to greater knowledge security.

In this sense, the present research intends to contribute to the diagnosis of the Student's thinking about the impact on the study/learning with artificial pieces of anatomy. Thus, offering subsidies to guide the actions of the teacher and, finally, of the educational institutions may reduce the difficulties faced in the course of the discipline in question.

5. Conclusion

Anatomy teaching methodologies are in a straightforward reformulation process with several technologies incorporated into these didactics. Artificial anatomical parts, in this way, have been widely used to replace or coexist with cadaveric features.

The biggest problem in studying anatomy for students seems to be almost unanimous about many structures to memorize and learn structure/function.

Students, in general, welcome the anatomical practice with the use of these models, attribute an excellent concept to their learning with artificial pieces, and perhaps, at times, they even prefer them to the detriment of the corpse, either for reasons of personal contact or even contact with chemical preservative substances.

According to our interviewed students, the practical classes with anatomical models are of good quality, with significantly good learning and guaranteeing them remarkable security in their future professional practice.

However, other investigations are necessary for this sense to study, understand and find solutions with didactic tools, techniques, and tactics that manage to preserve the importance of anatomy in the learning of courses in the health area, meeting the wishes of students and the work of the masters of the discipline.

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