Graduate and Undergraduate Students' Perceptions of the Spine Muscles Study Methods

Fernanda Vieira Botelho Delpupo,[1] João Gabriel Alexander,[1] Juliana Hott de Fúcio Lizardo,[1] Josemberg da Silva Baptista[1]

[1]Laboratory of Applied Morphology – LEMA, Department of Morphology, Universidade Federal do Espirito Santo, Vitória - ES, Brazil

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ABSTRACT

Introduction: the spine muscles are traditionally described as "back muscles". Several differences are found to determine the muscle classification/nomenclature and the topographic organization, which are often confusing or misleading. A recent alternative method to study the spine muscles based on specific functional and morphological criteria was published considering modern anatomy teaching - this new method proposes the spine muscles categorization in seven strata. This study aimed to investigate which method, the traditional or the seven strata, allows for a more accurate perception of knowledge.
Methods: 123 health science students in different academic levels attended lectures in both the traditional and the seven strata method. Descriptive statistics were used to present the multiple-choice or Likert-type scale questions, and the descriptive critical review was analyzed through thematic analysis.
Results: the overall students preferred the seven strata method as a comprehensive and didactic strategy to study the spine.
Conclusion: these results validate the seven strata method as a didactic strategy to teach spine muscles in medical, physical therapy, and postgraduation courses.
Keywords: Anatomy; Teaching; Spine muscles; Back muscles; Knowledge perception.

Introduction

The spine muscles are traditionally described as "back muscles" presented and organized according to five main features: topography, insertion, function, innervation and phylogenetic origin. Despite using similar criteria, the books reveal several differences to determine the muscle classification/nomenclature and the topographic organization. It can be assumed that these variations compromise the information process and knowledge formation. For example, terms as pre-, para-, and post-vertebral seem unclear to classify muscles. Some authors use these descriptions to label muscles in the cervical region[1–5], as well as to categorize "back muscles" in a partial[6] or complete way[2].

Other types of systematization such as "intrinsic or extrinsic back muscles", "proper back muscles" and "thoraco-appendicular muscles" still neglect muscles such as the intertransversarii mediales and lateralis lumborum, and the intertransversarii posteriores, mediales, and lateralis cervicis. Therefore those types of systematization do not comprise the complete description of the region[1–5].

An alternative method to study the spine muscles based on specific functional and morphological criteria had been published previously, trying to reach the modern anatomy method of teaching. This new method proposes seven strata named as follows: Vertebroappendicular (VA); Transversarium (TR); Deep Post-transversarium (DPT), Medium Post-transversarium (MPT) and Superficial Post-transversarium (SPT); Deep Spinoappendicular (DSA) and Superficial Spinoappendicular (SSA)[7].

Considering that, in the past few years, human anatomy courses have been losing time in order to reply to the new curricula in medical schools, many kinds of research are developing methods to potentialize students' comprehension and knowledge. Overall, the curricula in all health science courses around the world have undergone profound adaptations, especially in the basic cycle disciplines, including anatomy[8].

This study aimed to investigate which method, the traditional or the seven strata, allows for a more accurate perception of knowledge.

Methods

Ethical Committee

Undergraduate students from Universidade Federal do Espirito Santo and postgraduate students from Escola Superior de Ciencias da Santa Casa de Misericordia de Vitoria volunteered to participate in this study upon receiving a detailed explanation. All students signed the written informed consent form. All the methods of this study were approved by the Ethical Committee in Research with Human Beings (register number 69930417.1.0000.5060).

Experiment and Groups

The experiments were conducted with four groups of students who attended ordinary expositive lectures in two different ways to perform comparison: traditional (back muscles) 5 and seven strata 7 lecture. All seven strata lectures were performed by the same researcher (JSB):

Group 1:

Formed by physical therapists in the postgraduate program (musculoskeletal rehabilitation) who attended the traditional method lecture in their graduation courses (with different professors and at different universities), and then, in the postgraduate program, attended the seven strata method lecture.

Group 2:

Formed by undergraduate physical therapy students who first attended the traditional method lecture taught by the regular graduate professor in the physical therapy course, and then, in the following semester, attended the seven strata method lecture.

Group 3:

Formed by undergraduate medical students who first attended the seven strata method lecture, and subsequently attended the traditional method lecture by the same professor (JSB).

Group 4:

Formed by undergraduate medical students who first attended the traditional method lecture, and subsequently attended the seven strata method lecture by the same professor (JSB).

The questionnaire

The questionnaire was divided into four sections: (1) demographic questions; (2) multiple-choice questions related to the type of methods used in the lectures; (3) multiple-choice questions and Likert-type scale questions related to the students' perception of the methods; (4) optional critical review to comment about the methods 9,10. The students had free time to fill in the questionnaire in hard copies in their classrooms. Sections 2-4 were follow as described:

Section 2 - Lectures and type of methodology questions:

The questions in section 2 aimed to verify whether students were aware of which method they participated in.

In question (Q1) students were asked to identify the methodology used to study the "back muscles" or the "spinal muscles" in their first lecture. The options were: (a) non-criteria; (b) based on extrinsic (superficial and intermediate/middle) and proper or intrinsic (deep) back muscles; (c) based on seven strata muscles; (d) I cannot remember; (e) other (containing a blank line to answer what type).

In (Q2) students were asked to identify the methodology used to study the theme in their second lecture. The options were the same as in the first question.

Section 3 - Students' perception questions:

The questions in section 3 aimed to understand the students' perceptions about the spine/back muscles method used in the lectures.

In Q3 students were asked to choose the method they preferred by comparing the lectures. The options were: (a) non-criteria; (b) based on extrinsic (superficial and intermediate/middle) and proper/intrinsic (deep) back muscles; (c) based on seven strata muscles; (d) no preference; (e) other (containing a blank line to answer what type).

In Q4 students were asked to choose a preferred method to study the theme again. The options were the same as in Q3.

In Q5 students were asked to what extent they agree with the sentence "the seven strata method is functional and didactic". The options were: (a) strongly agree; (b) agree; (c) undecided; (d) disagree; (e) strongly disagree.

In Q6 students were asked to what extent they agree with the sentence "the seven strata method was better for my comprehension when compared to the traditional method of studying the spinal/back muscles". The options were the same as in Q5.

Section 4 - Optional critical review

Q7 stated, "Feel free to write about any perception you may have had of the back/spine muscles methods of study or about your experience with this research". This question was designed for comments on the methods of study.

Data analysis

Descriptive statistics (frequencies and percentages) were used to describe the answers to the multiple-choice or Likert-type scale questions in the questionnaire.

Section 2 focused on analyzing and comparing the students' answers regarding the group in which he/she belonged to. Section 3 was described in a gross and proportional analysis[11,12]. The proportional analysis was performed to equalize the number of subjects per methodology since G3 was the only group where the presentation of the methods was inverted (seven strata prior to traditional). To perform this analysis, the data were calculated using the total responses over the number of participants according to the study method (traditional versus seven strata, or seven strata versus traditional). The final effect was the normalization of the number of participants regardless of the group, offering a general picture of the result according to the methodology (G1+G2+G4 = G3 in numbers of participants).

The students' optional critical reviews (Section 4) were categorized according to the words or terms provided. These categories were evaluated through the thematic analysis[13,14]. Thus, each student's answers could be computed into many categories. However, specific information was related to only one category. According to the category, the descriptive statistics were applied to describe the reviews.

Results

Section 1 - Demographic questions

A total of one-hundred and twenty-six students had agreed to participate in the study and gave their written consent. The lectures in both methods take about 50-55 minutes long. Three students from G3 did not fill out the questionnaire, so they were excluded from the study. A total of one-hundred and twenty-three students filled out the questionnaire in all groups (G1 n = 17; G2 n = 44; G3 n = 37; G4 n = 25) with a mean time of 15 minutes per group (Table 1). Over two-thirds of the participants were female (85/38).

Table 1. Demographic profile of the subjects.

Characteristics	G1	G2	G3	G4
Age (mean ± SD)	27 ± 3,4	20 ± 1,6	19 ± 1,7	20 ± 2,0
Female	13	41	14	17
Male	4	3	23	8
Total of subjects (n = 123)	17	44	37	25

Section 2 - Lectures and type of methodology questions:

There were no disparities in Q1 and Q2 concerning what type of methodology was applied in the first lecture, and what type was applied in the second lecture. Thus, no other participant was excluded from this study, and the experimental groups kept it as planned.

Section 3 -Students' perception questions:

(Q3) In your opinion, what was the best method of study to comprehend the content "back muscles" or "spinal muscles"?

In all groups, and under proportional analysis, the majority of students chose the seven strata method as the best method for their comprehension of the content (Table 2). Although G3 and G4 preferred the seven strata method, they demonstrated a high appreciation for the traditional method as well.

(Q4) If you were to study again the theme "back muscles" or "spinal muscles", which classification method would you choose?

In all groups, and under proportional analysis, most of the students chose the seven strata method to study the theme again (Table 3). However, G3 also demonstrated a high opinion of the traditional method.

(Q5) The classification of the spinal muscles in seven strata, as described above, is functional and didactic.

In all groups, and under proportional analysis, the majority of students chose "agree" or "strongly agree"

Table 2. Results from Q3 when students were asked to choose the method they preferred by comparing lectures.

		Non-criteria	Traditional	Seven strata	Non-preference	Another
Regular groups	G1	-	18%	82%	-	-
	G2	-	7%	84%	9%	-
	G3	-	43%	54%	3%	-
	G4	-	44%	48%	8%	-
Proportional analysis	Trad/7strat	-	23%	71,33%	5,66%	-
	7strat/Trad	-	43%	54%	3%	-

Table 3. Results from Q4 when students were asked to choose a method to study the theme again.

		Non-criteria	Traditional	Seven strata	Non-preference	Another
Regular groups	G1	-	12%	88%	-	-
	G2	-	4%	89%	7%	-
	G3	-	46%	49%	5%	-
	G4	-	36%	60%	4%	-
Proportional analysis	Trad/New	-	17,33%	79%	3,66%	-
	New/Trad	-	46%	49%	5%	-

for the statement in Q5 (Table 4). Most students who chose "undecided" in Q5 belong to G1. G3 demonstrated the same percentage of students who chose "strongly agree" and "undecided". The higher percentage of students who selected "disagree" belong to G3 (Table 4). Not one single student checked "strongly disagree" in Q5.

(Q6) The method of dividing the "spinal muscles" into seven strata was better for my comprehension when compared to the traditional method (groups of extrinsic, and proper or intrinsic back muscles).

Most of the students "agree" with the sentence in Q6; moreover, the students in G2 "strongly agree" with it. This was the only question in which the option "strongly disagree" was checked. A high number of students in G3 and G4 chose "disagree" and "strongly disagree" for Q6. The major percentage of the students that chose "undecided" and "disagree" belongs to G4 (Table 5).

According to the proportional analysis, that was the only question in which the option "undecided" showed similar results between methodologies. Over 54% of the participants either "agreed" or "strongly agreed" that the seven strata method for the study of spinal/back muscles is better for their comprehension. Yet, about 11% of participants in one method and 30% in another chose the options "disagree" plus "strongly disagree" (Table 5).

Section 4 – Optional critical review

(Q7) Feel free to write about any perception you may have had of the seven strata method for the study of spinal/back muscles or about your experience with this research".

The optional comments in Q7 were analyzed and categorized in words or terms used by the participants to express, through comparison, the favorable and unfavorable aspects of the methods for the study of spinal muscles. In this way, the same student may have contributed to more than one category. Tables 6 and 7 summarized the main results.

The category named "comprehensible" included commentaries like "easy to understand", "understandable", "easy to understand the movements of the muscles", "easy to master", "easy to memorize". The category "didactic" included commentaries like "didactic", "practical", "thorough", "data integrated", "organized", "logical", "less confusing", "specific". The categories "effective/efficient" and "confusing" comprised commentaries with those exact words. The category called "complex" contained commentaries such as "complex", "hard to understand", "too many muscles", "too many names", "holds more information", "hard to memorize", "too many muscles per group".

The majority of comments in Q7 was made for the seven strata method of study (93 versus 22). Most of those comprised categories "didactic" and "comprehension", while the traditional method comprised categories "comprehension" and "didactic" respectively. Most participants related to categories "comprehension" or "didactic" regarding their experience with the seven strata method (85% and 72,7% respectively), while with the traditional method they referred to categories "complex" or "confusing" (27,3% and 12,9% respectively). Although the words "complex" and "confusing" appeared in both methods, the amount of citations containing "confusing" was the same despite the difference in the total number of comments.

Table 4. Results from Q5 when students were asked to what extent they agreed with the sentence "the seven strata method is functional and didactic"

		Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Regular groups	G1	41%	41%	18%	-	-
	G2	59%	41%	-	-	-
	G3	13,5%	57%	13,5%	16%	-
	G4	12%	76%	8%	4%	-
Proportional analysis	Trad/New	37,33	52,66%	8,66%	1,33%	-
	New/Trad	13,5%	57%	13,5%	16%	-

Table 5. Results from Q6 when students were asked to what extent they agree with the sentence "the seven strata method was better for my comprehension when compared to the traditional method of studying the spinal/back muscles".

		Strongly agree	Agree	Undecided	Disagree	Strongly disagree
Regular groups	G1	44%	44%	12%	-	-
	G2	48%	36%	14%	2%	-
	G3	19%	35%	16%	24%	6%
	G4	12%	32%	24%	28%	4%
Proportional analysis	Trad/New	34,66%	37,33%	16,66%	10%	1,33%
	New/Trad	19%	35%	16%	24%	6%

Discussion

This work analyzed two different methods of study for the spine muscles combined with 123 students in different academic levels and health courses. Such characteristics enabled the verification of the overall students' preference for the seven strata method to study the spinal muscles. To the authors' knowledge, no research had addressed the same matter before, preventing deep discussions. However, the students' heterogeneity in the groups avoided several biases and enriched the discussion.

Even with the proportional analysis, the majority of students preferred the seven strata method referring to it as "didactic" and "functional" (Table 4), thus providing a better understanding of the subject (Table 5, Table 6). This perspective can be justified by the greater systematization of the new method, which would, in such a way, favor the establishment of more consolidated and effective knowledge. Although the lectures took approximately the same time, the seven strata method provided a more comprehensive perspective of the structures, serving as a foundation for the interpretation of signs and symptoms, mainly because it addresses segmentation in a more detailed way and avoids misleading information. Also, it can be considered as a modern strategy, which allows for a more precise approach to the content, and which can be used in any curricula[7,15–17].

Despite the main result of this study, G3 and G4 gathered the highest preferences for the traditional method in Q3 (Table 2), and this result was confirmed by G3 in Q4 (Table 3). These data may suggest hesitation to new methodologies in contrast to traditional teaching methods [18,19]. Meireles *et al.* evaluated the expectations of medicine students regarding academic training in the new National Curriculum Guidelines (NCGs)[20,21]. They found that the students were reluctant to the inclusion of new subjects and new methodologies in opposition to traditional teaching methods. Although the medicine NCGs recommend the adoption of new strategies in curricula, a vast majority of students prefer the passive process for memorizing content [11,18,19,21]. This can be authenticated by G3 as the main group to describe the traditional method as "comprehensible" (Table 6), as well as to exhibit few differences regarding the preferred methods of study in the future (Q4, Table 3).

Interestingly, G3 and G4 were the main groups to consider the seven strata a "didactic" as well as "complex" methodology (Table 6). Moreover, G3 was the main group to "disagree" that the seven strata method is "functional and didactic" (Table 4). This paradox brings into consideration the moment in which the methodology was presented to those groups; G3 and G4 attended this research in their regular clinical oriented anatomy course in a subsequent-lecture fashion. As a new teaching proposal, the seven strata method is not found in any of the anatomy books in the students' bibliography. Therefore, considering that they had attended the seven strata method in their regular disciplines, fear and distrust may have emerged when answering Q4, Table 3. The statement "comprehensible", referring to the traditional method, may add to rationalize this paradox in G3 (Table 6). Regarding the statement "complex", chosen to describe a method composed of all spine muscles divided into 7 groups rather than the plain 2 large back muscles systematization, students may have had the impression that the new method is more "complex" to memorize and consolidate knowledge[18,22]. Nonetheless, the absence of answers "didactic" and "comprehensible" chosen by G1 and G2 for the traditional method (Table 6 and 7), suggest this as another factor that has led to different opinions among students in medical and

Table 6. Results from the Q7 for the seven strata method of study.

Groups	Comprehensible	Didactic	Effective/Efficient	Complex	Confusing	Total answers
G1 (n = 17)	2	-	-	-	-	2
G2 (n = 44)	21	15	1	1	1	39
G3 (n = 37)	4	17	-	6	1	28
G4 (n = 25)	2	18	1	3	-	24
Total answers (n = 123)	29 (31,2%)	50 (53,8%)	2 (2,1%)	10 (10,8%)	2 (2,1%)	93

Table 7. Results from the Q7 for the traditional method of study.

Groups	Comprehensible	Didactic	Effective/Efficient	Complex	Confusing	Total answers
G1 (n = 17)	-	-	-	-	-	-
G2 (n = 44)	-	-	-	1	2	3
G3 (n = 37)	9	3	-	3	-	15
G4 (n = 25)	1	3	-	-	-	4
Total answers (n = 123)	10 (45,4%)	6 (27,3%)	-	4 (18,2%)	2 (9,1%)	22

physical therapy courses. Amid those results, there is a need to reduce hours in clinically oriented anatomy courses in the new paradigmatic curricula without losing content[7,16,23]. The strategies to teach anatomy focusing on "how to approach" are based on the pedagogical process, which helps to identify study strategies that challenge and recognize weaknesses, as well as take advantage of strengths[17,24,25].

G2 was the main group to state in Q7 that the seven strata method is "didactic" and "comprehensible". Moreover, G1 offered the fewest amount of comments on the same question. These data may suggest an open opinion from those students or perhaps a sign of maturity as long as they are not in the first semester of their undergraduate course. This assumption can be a reflection of a young course as physical therapy, recognized as a health profession in Brazil only in 1969[26]. Thus, although the majority of students in all courses and all analyses pointed to the seven strata method as their preference to study the content again, the difference between physical therapy students and medical students is drastic (Table 3)[27]. Such evidence is outlined in table 4, where only medical students disagree that the seven strata method is functional and didactic, and in table 5, where only medical students strongly disagree that this method is better

for understanding the content covered.

This study has three major limitations: 1) For not using a virtual questionnaire, the acquiescence bias may have occurred when filling out the questionnaire immediately after the second lecture. 2) The students' perception of the last presentation may have caused bias when interpreting it as "better" than the first presentation, even though G3 was formed to avoid such bias. Nonetheless, the data normalization provides a strict view of the data among the different number of students in the groups. 3) Since the groups were heterogeneous in academic levels and health courses, G1 and G2 did not have a controlled first-lecture.

Conclusion

Such results validate the seven strata method as a didactic strategy to teach spine muscles in medical, physical therapy, and postgraduation courses.

Acknowledgments

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Mini Curriculum and Author's Contribution

1. Fernanda Vieira Botelho Delpupo: PT Student – Conceptualization, Validation, Formal analysis, Writing – Original Draft Preparation, Reviewing and Editing. ORCID: 0000-0002-0700-2290.

2. João Gabriel Alexander: Medical Student – Conceptualization, Validation, Formal analysis, Writing – Original Draft Preparation, Reviewing and Editing. ORCID: 0000-0001-5693-7263.

3. Juliana Hott de Fúcio Lizardo: PhD – Conceptualization, Validation, Formal analysis, Supervision, Writing – Original Draft Preparation, Reviewing and Editing. ORCID: 0000-0001-7768-3098.

4. Josemberg da Silva Baptista: PhD – Conceptualization, Methodology, Validation, Formal analysis, Investigation, Supervision, Writing – Original Draft Preparation, Reviewing and Editing. All authors have read and approved the manuscript. ORCID: 0000-0003-0514-8170.

Corresponding author
Fernanda Vieira Botelho Delpupo
E-mail: fernanda.delpupo@edu.ufes.br