



Importance of Anatomy Education on Electrotherapy Lectures in Physiotherapy and Rehabilitation Curricula: Student Perceptions of a Foundation University

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Accepted: 12 July 2021

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Abstract

Student opinions are important to improve the physiotherapy and rehabilitation curriculum, and to maintain the quality of education. This study aimed to evaluate the students' perception levels related to anatomy education in terms of electrotherapy lectures. Third and fourth-year physiotherapy students (61 female, 43 male) have voluntarily participated in this study. The data were obtained by a survey, which consists of 29 closed-ended (15 Likert-type questions) questions. The average age was 21.82 ± 1.62 years. The grade point average of the participants, which is based on the 4-point scale, is 2.33 ± 0.44 points. There was no difference between the genders in terms of the grade point averages ($p=0.78$). Students stated that the anatomy knowledge of the musculoskeletal system is extremely important in terms of electrotherapy lectures. This is followed by the nervous system and the circulatory system, respectively. They also stated that they need more anatomy knowledge during motor point stimulation applications (50%), and less anatomy knowledge during ultrasound applications (15.38%). In the results of Likert-type survey, first and second highest scores were pertained to "I need anatomy knowledge when inserting electrodes" and "The knowledge which is obtained from anatomy lectures affect to the motor nerve stimulations" (1.42 ± 0.67 and 1.40 ± 0.66 , respectively, $p < 0.05$) and the least score was pertained to "I need to look at my anatomy notes before the electrotherapy exams" (0.41 ± 0.88 , $p < 0.05$). The results from this study help to enhance our conceptual understanding of students' perception levels of anatomy education importance in terms of electrotherapy lectures.

Keywords Anatomy education · Basic science · Electrotherapy · Physiotherapy education · Student perception

Introduction

Anatomy has an important part in the foundation of healthcare education. It is the fact that healthcare professionals may require a good knowledge of anatomy to be better in their fields [1]. In some professions allied to medicine, such as physiotherapy, students gain a profound understanding of human anatomy in practice, probably as a result of their experiences in extensive peer examination and living anatomy during the course of the program [2]. In Turkey,

physiotherapy education is established as 4 years. Anatomy is taught to physiotherapy students in their first year at university. Physiotherapists know the depth of gross anatomical knowledge required for safe treatment, and effective clinical practice [3, 4]. Anatomy I and Anatomy II, which are the lectures of basic medical sciences, and Electrotherapy I–II lectures are compulsory lectures in the physiotherapy and rehabilitation curricula [5]. Anatomy, which is a prerequisite course for health programs, is a pathway to success in the other lectures of physiotherapy and rehabilitation program, also in lectures of other health sciences. Anatomy knowledge is needed as a gatekeeper in some subjects which are fundamentals of the Electrotherapy I–II lectures. The correct application of electrotherapy treatments on patients requires physical therapists to have extensive knowledge of anatomy [6]. It is very important to perform the applications correctly in terms of patient safety, the effectiveness of the treatment, and the clinical success of the physiotherapist. It is the fact that one of the keys to the professional success of

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physiotherapists is to understand the theoretical and practical knowledge of anatomy and electrotherapy lectures, and to make associations between them [7, 8]. Lecturers in the physiotherapy and rehabilitation departments expect from students to gain knowledge of anatomy, and practice of electrotherapy.

The participation of students is important in studies for increasing the quality of physiotherapy education. However, no study about the opinions of the students of the physiotherapy and rehabilitation department on this subject has been encountered. In this study, considering the lack of in the literature, our physiotherapist candidate students' perception levels related to anatomy education in terms of electrotherapy lectures were investigated. The following research questions were explored:

- (1) What are the students' perceptions about both lectures?
- (2) Do the students realize the relationship between the two lessons?

Methods

Participants and Ethical Approval

Third and fourth-year physiotherapy students in Hasan Kalyoncu University, Faculty of Health Sciences, Department of Physiotherapy in Gaziantep participated in this study. Ethics committee approval was obtained from the local Ethics Committee before this cross-sectional, descriptive study (decision no: 2019/113). All the data were collected in December 2019. A survey was implemented, and a total of 104 students voluntarily participated in the study. It was the 70.2% of the total universe of study population. They were asked to participate voluntarily in the implementation of the survey. The students were motivated as that they have an important contribution to the development of teaching methods of these lectures. The inclusion criteria was that the students have completed the Anatomy I, Anatomy II, Electrotherapy I, and Electrotherapy II lectures. The survey was administered by a staff member who did not teach the lectures.

Survey Structure

A survey is a system for collecting information from or about people to describe, compare, or explain their knowledge, attitudes, and behavior [9]. The survey that we used in this study was not a standardized instrument, and used as a guideline as it was designed to collect data on the views and perceptions about the importance of anatomy education on electrotherapy lectures of physiotherapy students. Data were obtained by the survey, prepared by the researchers (*they*

have nearly 10 years of experience in teaching anatomy and electrotherapy) according to the literature, which was consisted of 29 closed-ended questions. Likert-type scale was used in 15 questions (−2 for totally disagree up to 2 for totally agree) which were including completely agree, agree, no idea, disagree, and completely disagree. In the survey, there were also questions about demographic characteristics, academic success, and the order of importance of anatomical systems on electrotherapy education. The purpose of the study was explained to the students, and the hard copies of the surveys were distributed to them. It was optional for students to write their identity for the reliability of the feedback.

Statistical Analysis

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS Version 22, Armonk, NY: IBM Corp.). The level of statistical significance was set at $p < 0.05$. The variables were investigated by visual (histograms, probability plots) and analytical methods (Shapiro–Wilk test) to determine whether they were normally distributed. Descriptive statistics were calculated for all variables, and the data were shown as mean \pm standard deviation (SD), median (minimum–maximum), and frequencies and percentages. The gender difference and categorical data were compared by using chi-square test. The one-way ANOVA was used to analyze the continuous variables.

Results

Sixty-one (58.7%) female and 43 male (41.3%) students participated in this study. The average age of the students was 21.82 ± 1.62 (min 19, max 28). The grade point average, of the participants, which is based on the 4-point scale, was 2.33 ± 0.44 points, and the grade point average ranges are given in Table 1. There was no difference between the genders in terms of the grade point averages ($p = 0.78$).

Table 1 Distribution of student numbers according to the grade point average ranges

Grade point ranges	N (%)	p
1.00–1.49	3 (2.88)	0.001*
1.5–1.99	20 (19.23)	
2.00–2.49	46 (44.23)	
2.5–2.99	24 (23.07)	
3.00–3.49	10 (9.61)	
3.5–4.00	1 (0.96)	

* $p < 0.05$ is statistically significant

Third and fourth year students participated in this study, because the inclusion criteria of the study was to complete the Anatomy I and Anatomy II, Electrotherapy I, and Electrotherapy II lectures. Forty five (43.26%) of the students participating in this study were 3rd year students, and 59 (56.73%) were 4th year. The number of students who repeated the Anatomy I, Anatomy II, Electrotherapy I, and Electrotherapy II lectures are given in Table 2.

A total of 83.65% ($n = 87$) of the students have repeated the course for the second time. Exactly 41.37% ($n = 36$) of the repeated Anatomy I, 45.97% ($n = 40$) of them did Anatomy II. A total of 8.04% ($n = 7$) of those students have repeated Electrotherapy I, and 4.59% ($n = 4$) of them have repeated Electrotherapy II.

The responses were scored based on the Likert scale, from -2 to 2 points for “totally disagree” through “totally agree” comments. The perceptions of students about both lectures were compared with 15 Likert-type questions, and statistically significant decisions were examined (Table 3). First and second highest scores were pertained to “I need anatomy knowledge when inserting electrodes” and “The knowledge which are obtained from anatomy lectures affect to the motor nerve stimulations” (1.42 ± 0.67 and 1.40 ± 0.66 , respectively), and the least score was to “I need to look at my anatomy notes before the electrotherapy exams” (0.41 ± 0.88) which were statistically significant ($p < 0.05$) (Table 3). Also, the number of individuals who think that anatomy knowledge is important in terms of applying electrotherapy modalities and the distribution according to the modalities are given in Table 3. Accordingly, they stated that they need more anatomy knowledge during motor stimulation applications (50%), and less anatomy knowledge during ultrasound applications (15.38%).

The order of importance of the systems, which are learned in the anatomy lectures, in terms of affecting the success of the electrotherapy lectures is given in Table 4. Accordingly, the students stated that the anatomy knowledge of the musculoskeletal system is extremely important in terms of electrotherapy lectures. This is followed by the nervous system and the circulatory system, respectively. The system they find the least relevant by electrotherapy lectures is the genital system anatomy (Table 4).

Discussion

Clinical practice is directly related to the curriculum of physiotherapy and rehabilitation. The current physiotherapy curriculum includes theoretical and practical parts which both lessons are closely related. Electrotherapy and anatomy lectures, which are practice-oriented lectures, are among the basic lectures of the first four semesters of physiotherapy curriculum. Anatomy education, which is taken in the first and second semesters of the curricula, forms the basis of the student’s professional knowledge in the field of physiotherapy and rehabilitation. Anatomy knowledge is needed during the theoretical and practical applications of the electrotherapy lecture. The placement of electrodes, localization of tissues, and characteristics of cell structures can change the type of electrotherapy current and application [1–3, 10, 11]. This study, which is essentially a curriculum evaluation study in a foundation university, addressed the perception levels of students related to the anatomy education in terms of electrotherapy lectures.

The practice of a successful clinical electrotherapy is correlated with the skills of the assessment and treatment. The treatment approach may vary from the one physiotherapist to another, depending on their knowledge and experience [1, 2]. In Turkey, since the end of the second year, physiotherapy students begin to observe patients through the clinical applications. Third and 4th year students were included in this study because of they gained patient observation education, anatomy and electrotherapy knowledge during the treatment of the patient. The students participating in our study stated that the success of anatomy practical lessons affects the success of electrotherapy lessons. The expression of the students about the relationship between these two lessons is promising for the educators.

Students’ feedback provides subjective data for assessing the educational needs [12, 13]. Likert-type surveys are preferred in the studies which conducted by taking the student opinions [14]. We have created Likert-type questions in accordance with the literature. According to the answers of the Likert-type questions, the students answered on a high score that they need anatomy knowledge while placing the electrodes. Second highest score was that they need anatomy knowledge during motor point stimulations. It is also stated

Table 2 Distribution of students according to the repeated lectures

	Once	2nd	3rd	4th	5th	6th
Anatomy I	63	36	3	2	-	-
Anatomy II	55	40	7	2	-	-
Electrotherapy I	96	7	1	-	-	-
Electrotherapy II	98	4	-	-	1	1

Data is represented as frequency

Table 3 The survey items, students' responses to the both lectures, and the examination of the statistically significant decisions

	Com- pletely agree (n)	Agree (n)	No idea (n)	Disagree (n)	Completely disagree (n)	X ± SD	p
The success in the theoretical part of anatomy effects to the success on theoretical part of electrotherapy lecture	24	38	15	25	2	0.95 ± 0.74	0.001
The success in the practical part of anatomy effects to the success on practical part of electrotherapy lecture	27	37	18	18	4	1.00 ± 0.76	0.001
The knowledge which is obtained from anatomy lectures affect to the TENS applications	25	34	19	23	3	0.96 ± 0.76	0.001
The knowledge which is obtained from anatomy lectures affect to the Russian current applications	29	37	16	21	1	1.05 ± 0.72	0.001
The knowledge which is obtained from anatomy lectures affect to the motor nerve stimulations	52	25	17	10	0	1.40 ± 0.66	0.001
The knowledge which is obtained from anatomy lectures affect to the interferential current applications	25	32	25	21	1	1.01 ± 0.69	0.001
The knowledge which is obtained from anatomy lectures affect to the ultrasound applications	16	34	21	30	3	0.80 ± 0.72	0.001
I need anatomy knowledge when inserting electrodes	55	22	16	11	0	1.42 ± 0.67	0.001
Anatomy knowledge is important in choosing the suitable current for the patient and pathology	23	32	13	26	10	0.77 ± 0.90	0.001
Anatomy illustrations are effective in learning electrotherapy lesson	37	28	16	20	3	1.10 ± 0.81	0.001
I think that I will use in my professional life what I learned in electrotherapy lectures	47	26	12	17	2	1.25 ± 0.79	0.001
I think that I will use in my professional life what I learned in anatomy lectures	62	25	8	8	1	1.50 ± 0.68	0.001
There were questions, which examine my anatomy knowledge, in the exams of electrotherapy lectures	19	31	18	33	3	0.93 ± 1.32	0.001
I need tips to remind my anatomy knowledge in electrotherapy exams	25	26	29	24	0	1.00 ± 0.68	0.001
I need to look at my anatomy notes before the electrotherapy exams	13	23	9	44	15	0.41 ± 0.88	0.001

p < 0.05 is statistically significant. Data is represented as frequency

in the literature that anatomy knowledge is needed for motor point stimulation and electrode placement [15]. The results of our study supported the literature, and also, the points that the lecturers found important were emphasized by the students.

Anatomy is a backbone lecture for many disciplines such as nursing, nutrition and dietetics, physiotherapy, medicine, and associate degree health professions education (dialysis, anesthesia, paramedics etc.). In addition to these sciences, anatomy is also taught in sports sciences, psychology, fine

Table 4 The examination of the statistically significant parameters and the order of importance of the systems, which learned in the anatomy lectures, in terms of affecting the success of the electrotherapy lectures

Systems	1	2	3	4	5	6	7	8	P
Musculoskeletal system	94	5	-	4	-	-	-	1	0.001
Circulatory system	2	25	53	13	9	1	1	-	0.001
Respiratory system	3	8	12	53	16	5	4	3	0.001
Urinary system	-	4	4	2	21	40	23	10	0.001
Genital system	-	1	1	2	1	9	28	62	0.001
Endocrine system	-	-	6	22	31	12	27	6	0.001
Digestive system	-	-	3	4	22	34	19	22	0.001
Nervous system	5	61	25	5	4	2	2	-	0.001

p < 0.05 is statistically significant. Data is represented as frequency

arts (artistic anatomy lectures), engineering (anthropometry and ergonomics), and faculty of education departments (pre-school teaching and special education teaching) [16, 17]. We have to emphasize the needs better, while preparing the anatomy course contents of all these departments. Also, the necessity of anatomy education should be emphasized better in other health science courses. It is important to provide a perspective on which areas and how anatomy will work. It is important to provide anatomy education for the purpose of each department and lecture.

As it is already known, as well as physiotherapists physiotherapy technicians (graduated from a 2-year course in vocational schools) can also apply electrotherapy modalities. Anatomy education that given to physiotherapy technicians is not as detailed and deep as given to the physiotherapists [18]. Based on this, it can be understood that there is no need a deep anatomy knowledge for electrotherapy applications. According to our study results, it was predictable that the students did not need much anatomy knowledge during

ultrasound applications and some another electrotherapy applications. This knowledge, which was acquired through student feedbacks, has also been proven by the educators of this study.

In our study, students' need to look through anatomy knowledges before the electrotherapy exams were preferred at the lowest level. This may be due to the general characteristics of the Z generation. Z generation is generally closed to traditional teaching methods, and the way that they learn theoretical knowledge is more interactive [19, 20]. It can be thought that the students who participated in our study found the applied and interactive education more effective, and put the theoretical knowledge on the second plan. Based on this, the anatomy lecturer participated in Elsevier's Complete Anatomy online education, and brought the demo version of the program to the university library. Available contents from Elsevier's Complete Anatomy 2021 platform are more than 17,000 different contents, videos, over 100 h of lessons prepared by experts

Fig. 1 Electrotherapy lecture contents which were revised in response to student feedback

Course name: Electrotherapy I		Term: Autumn period	Year: 2020-2021
Course credit: 2 theoretical+2 practical			
Distribution of the course contents according to the weeks			
I.	Introduction to electrotherapy		
II.	Principles and mechanisms of electrophysiology and heat		
III.	Direct currents + Iontophoresis+Practice		
IV.	Alternating currents (Sinusoidal Current, Diadynamic Current)		
V.	Stimulation of healthy muscle, stimulation of denervated muscle and accommodation		
VI.	Galvanic current+Practice		
VII.	Theoretical Exam		
VIII.	Revising Anatomy Knowledge + Faradic current and motor point stimulation		
IX.	Low frequency currents + Practice		
X.	Revising Anatomy Knowledge + theories of pain modulation, TENS mechanism and principle		
XI.	Treatment procedure of TENS+Practice		
XII.	Practical Exam		
XIII.	Revising Anatomy Knowledge + Elektrodiagnosis+Practice		
XIV.	Exam (theoretical and practical)		
Course title: Electrotherapy II		Term: Spring period	Year: 2020-2021
Course credit: 2 theoretical+2 practical			
Distribution of the course contents according to the weeks			
I.	Revising Anatomy Knowledge + Diadynamic currents+Practice		
II.	Revising Anatomy Knowledge + Interferential and Russian currents+Practice		
III.	High voltage pulsed current/Ultra Reiz/Microcurrent electrical stimulation		
IV.	Practice		
V.	High Frequency Currents+Practice		
VI.	Short wave diathermy/Pulsed shortwave diathermy+Practice		
VII.	Exam (theoretical and practical)		
VIII.	Microwave diathermy/Pulsed microwave diathermy+Practice		
IX.	Ultrasound+Practice		
X.	Magnetotherapy+Practice		
XI.	Biofeedback+Practice		
XII.	Functional Electrical Stimulation (FES) +Practice		
XIII.	Extra Corporeal Shock Wave Therapy (ESWT) +Practice		
XIV.	Exam (theoretical and practical)		

in their field, full body model designed to be closest to the real human body, detailed microanatomy models, radiology module, and cadaver images. Labeling, marking, and sectioning options on the model are possible. Academician tools just like student panel features where the lecturer can create course contents and quizzes share contents with students, and keep tracks of students' performance (this is the promotional video link <https://vimeo.com/290515631>).

In the light of the opinions of our students about these lectures, we believe that the practical hours of both lectures could be increased. The curriculum of Hasan Kalyoncu University for each semester is delivered over 14 weeks. It includes 4 h of theoretical lectures and 2 h of practical lectures for Anatomy, and 2 h of theoretical and 2 h of practical lectures for Electrotherapy. It may be beneficial to practice one more hour for both courses. The necessary feedback was given to the head of the department in order to increase the practical course hours of both courses. Electrotherapy lecture syllabuses were revised in line with student feedback. "Revising anatomy knowledge" part added to the course contents according to student feedback (Fig. 1).

It is obvious that the students need the most musculoskeletal anatomy knowledge during muscle strengthening applications in electrotherapy lectures. Nervous system anatomy knowledge is also needed in nerve injuries and electrotherapy applications to the nerve trace (for example sciatic nerve trace). Circulatory system anatomy knowledge is required during applications related to increasing blood circulation and edema treatment [1, 21]. By giving their answers similarly, the students stated the importance order of the anatomy system knowledge affecting the electrotherapy lectures, firstly the musculoskeletal system, secondly the nervous system, and finally the circulatory system.

It is thought that visuality is important for learning since an important part of the cerebral cortex is mainly reserved for visual process, 80% of the information coming to the brain comes through the visual organ [22]. For this reason, anatomy revising boards related to musculoskeletal system, nervous system, and circulatory system were hung in the electrotherapy laboratory to positive effects on learning.

Our study was planned to determine the awareness levels of physiotherapy and rehabilitation students about anatomy and electrotherapy lectures and to determine the importance of anatomy education for students in terms of electrotherapy lectures. We think that it is important to take student opinions to improve the physiotherapy and rehabilitation curriculum and to maintain the quality of education. Similarly, future studies could be planned to determine the importance of anatomy education for students in terms of other lectures such as biomechanics and kinesiology. We hope the results of this study will contribute to the physiotherapy curriculum in terms of both courses.

Conclusions

In the light of the results of our study, the suggestions to refine and improve the physiotherapy and rehabilitation program in terms of both lessons are given below:

- Simulation environments for the anatomy and electrotherapy lessons can be created.
- Anatomy and electrotherapy laboratories can be reorganized. Revision anatomy boards, especially related to musculoskeletal system, circulatory system, and nervous system, can be hung on the wall of the electrotherapy laboratory.
- Revision anatomy notes and videos can be added to the electrotherapy course plan.
- Additional methods can be used in the evaluation of educational effectiveness. Interactive lessons can be planned in which the lecturer of the both lessons participated.
- In electrotherapy lectures, permanence of learning can be achieved by interim assessments at important points to remember about anatomy.

Limitation

This study is limited with the answers of students who gathered in the survey. The participants involved in the study were assumed to give their answers to the instruments honestly. Also, the sample size of this local evaluation study could be enlarged in the subsequent studies about physiotherapy curriculum. This was a cross-sectional study by design but perhaps could be strengthened by a longitudinal approach and the survey could be validated in the future studies. Also, the study could be strengthened in future studies by the triangulation of other data points to determine the educational effectiveness.

Declarations

Ethical Approval 2019/113.

Informed Consent Written informed consent was obtained from all study participants.

Conflict of Interest The authors declare no competing interests.

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