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Research Article

The Need of Vertical Integration of Anatomy Education in Medical Schools

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Abstract

Background: It is stated in many studies that the anatomy knowledge of medical students decreases with time and "the negligence of vertical integration in anatomy teaching" is put forth as one of the reasons. In this study, we tried to draw attention to the need of vertical integration of anatomy education in medical schools with the questionnaire.

Methodology: The study was conducted with 3rd - 6th grade students, practicing physicians, research fellows, specialists and lecturers from various medical faculties. The participants were asked to answer 16 questions with 5 options prepared in the form of a Likert test.

Results: Anatomy education which is among the curriculum during the first years of medical schools is usually forgotten in the following years since it relies on memorization. Therefore, a reminder lessons in clinical internships will be useful in terms of vertical integration. We also think it will be useful to update the curriculum by making minor changes with regard to the method, content and clinic relation of anatomy education (in accordance with vertical and horizontal integration).

Conclusions: We think it is necessary to prepare a standard for anatomy that is compatible with the one that is planned to be made according to the National Core Education Program (UCEP-2014) in undergraduate medical education.

Keywords: *Anatomy; Vertical Integration; Medical Education; Curriculum*

Introduction

We have gained an enormous knowledge through the developing technology. It is necessary with regard to certain systems for the right of access to information in the information chaos and to transmit it in the most convenient way. Education programs and the studies carried out for improving these programs are increasing especially in the 20th century [1]. The focus of the past 30 years has been on developing new curriculum models and having them go into effect in the whole world. Despite this interest, there have been few hypotheses related to medical science education. The main changes in syllabi and curricula in medical education took place during the 20th century [2-8].

The question "How do we educate students in the first two years of medical school" is approached differently in many medical schools. Efficient medical education should be viewed as a continuum, integration of basic sciences and clinical medicine should occur throughout the syllabus, and self-directed, life-long learning should be emphasized [9].

All curriculum models aim to provide new features to their main subject community in a definite period of time. These features can be classified under three main headings: a) information (or knowledge) areas, b) skill areas and c) behavior areas. The objective should be to provide students with all these objectives in a pre-determined manner by way of standard anatomy education. Students can only

acquire information through amphitheater lectures, prosections of cadavers and multiple-choice questions (MCQ) exams. The percentage of cadaver dissections which can provide many skills and cool behavior habits to students as well as studies carried out on live human models are is very low and it even seems as if they do not exist. The limited number of cadavers causes the practical education of medical students to be weaker.

Many physicians agree that accurate knowledge of anatomy and variations is vital to ensure safe and efficient clinical practice. It has been stated in many studies that the anatomy knowledge of students of medicine decrease with time and "the negligence of vertical integration in anatomy teaching" is listed among significant reasons for this. Therefore, reminder lessons during some clinic internships (especially at the beginning of clinic internships) will be useful in terms of vertical integration [10,11].

Student feedbacks are one of the common research methods to assess the level reached through the education process, defining and completing missing points and correcting mistakes. Feedbacks help the participants to partake in the education process. Therefore, this research method is commonly used and has become an integral part of the education programs in the operating period [12].

In this study; we tried to draw attention to the need for vertical integration in medical schools through the questionnaire we prepared. We tried to discuss our findings and present conclusions with recommendations for further research.

Materials and Methods

The study was examined and approved by the Clinical Research Ethics Committee at Afyon Kocatepe University. Following the acquisition of the required permissions from the deans of faculty, the questionnaires were handed out by lecturers of the anatomy department in April during the 2013-2014 academic year. The questionnaire was conducted on 3rd - 6th grade medical students, practicing physicians, research fellows, specialist doctors and lecturers from Medical Schools of Afyon Kocatepe University, Pamukkale University, and Namık Kemal University. Some people also participated in the questionnaire via the internet and social media. The participants were chosen from those who received an integrated education.

In the questionnaire, the participants were asked to answer 16 questions with 5 choices (1- Strongly disagree, 2- Disagree, 3- Undecided, 4- Agree, 5- Strongly agree), prepared in the form of a Likert test.

Age, gender, class, and title were indicated anonymously in the questionnaires. It took seven minutes on average to fill out the questionnaire. The acquired data and answers to questions were grouped statistically and via calculated percentages. Answers of the participants were categorized by grouping. Three groups were created in total; "strongly disagree and disagree" forms a group, "undecided" form a separate group, and "agree and strongly agree" forms another group.

Results and Discussion

Demographics of respondents

464 volunteers participated in the study. 33.4% were students or employees at Afyon Kocatepe University; 28% were from Namik Kemal University, 12.7% were from Pamukkale University whereas 25.9% participated online. 50.2% were female and 49.8% were male. 82.8% were medical students, 5.6% were practitioner physicians or research fellows, 1.1% were specialists and 10.5% were lecturers. 38.4% of the students were 3rd graders, 31.3% were 4th graders, 6% were 5th graders and 7.1% were 6th graders (Table 1).

Gender and number of participants	The medical faculty participated in the study and number of participants	Education level and number of participants	Class and number of students
Female 233 (50,2%)	Afyon Kocatepe University 155 (33,4%)	Medical student 384 (82,8%)	3rd class 178 (38,4%)
Male 231 (49,8%)	Namık Kemal University 130 (28%)	Practitioner physicians/resc fellows 26 (5,6%)	4th class 145 (31,3%)
	Pamukkale University 59 (12,7%)	Specialist physicians 5 (1,1%)	5th class 28 (6%)
	Via the internet 120 (25,9%)	Lecturer 49 (10,5%)	6th class 33 (7,1%)

Table 1: *The distribution of participants by category.*

Questionnaire responses

The Likert type responses to the questionnaire of the participants have been given in table 2.

1. "I think that I took adequate anatomy courses for the medical profession. Therefore, it is not necessary to make changes in the syllabus". (32% of the respondents strongly agree or agree with the statement, 26% are undecided, 42% disagree or strongly disagree).
2. "I think anatomy course was a waste of time for me". (16% of the respondents strongly agree or agree with the statement, 14% are undecided, the majority of them (70%) disagree or strongly disagree).
3. "First and second year anatomy courses should be reminded during the 4^{th} and 5^{th} year at the school of medicine". (Almost half of the respondents (57%) strongly agree or agree with the statement, 16% are undecided, 27% disagree or strongly disagree).
4. "I would like to be taught anatomical information by an anatomist during the internship". (43% of the respondents strongly agree or agree with the statement, 19% are undecided, 38% disagree or strongly disagree).
5. "I think that the duration of the anatomy course is sufficient". (62% of the respondents strongly agree or agree with the statement, 18% are undecided, 20% disagree or strongly disagree).
6. "I think that the number of anatomy courses is sufficient". (63% of the respondents strongly agree or agree with the statement, 18% are undecided, 19% disagree or strongly disagree).
7. "Number of hours of anatomy lectures/theoretical courses should be increased". (A few respondents (19%) strongly agree or agree with the statement, 17% are undecided, 64% disagree or strongly disagree).
8. "Number of hours of anatomy practical courses should be increased". (More than half of the respondents (63%) strongly agree or agree with the statement, 12% are undecided, 25% disagree or strongly disagree).
9. "Associating anatomy lectures with problem-based teaching (PBL) reinforces my learning". (Majority of the respondents (61%) strongly agree or agree with the statement, 20% are undecided, 19% disagree or strongly disagree).
10. "Associating anatomy practical courses with problem-based teaching (PBL) reinforces my learning". (Majority of the respondents (67%) strongly agree or agree with the statement, 18% are undecided, 15% disagree or strongly disagree).
11. "Anatomy lectures supported by clinical data reinforce my learning". (Great number of the respondents (85%) strongly agree or agree with the statement, 8% are undecided, 5% disagree or strongly disagree).
12. "Integrated education system has enabled us to better understand the anatomy courses". (41% of the respondents strongly agree or agree with the statement, 44% are undecided, 15% disagree or strongly disagree).
13. "Cadaver dissection should be performed during practical anatomy courses". (A great deal of the respondents (73%) strongly agree or agree with the statement, 12% are undecided, 15% disagree or strongly disagree).
14. "Radiological and sectional anatomy lessons should be added to the anatomy lectures". (A large number of respondents (78%) strongly agree or agree with the statement, 10% are undecided, 12% disagree or strongly disagree).
15. "Radiological and sectional anatomy lessons should be added to the anatomy practical classes". (Majority of the respondents (78%) strongly agree or agree with the statement, 10% are undecided, 12% disagree or strongly disagree).
16. "If the anatomy course is added to the syllabus as an elective course, I will select it in addition to regular education". (42% of the respondents strongly agree or agree with the statement, 20% are undecided, 38% disagree or strongly disagree).

Ideas/ Opinions	1 - 2	3	4 - 5
1- I think that I have received adequate anatomy course for medical profession. Therefore, it is not necessary to make changes in the curriculum.	42	26	32
2. I think anatomy course was a waste of time for me.	70	14	16
3. First and second years anatomy courses should be reminded in 4th and 5th year in faculty of medicine.	27	16	57
4. I would like to be teach anatomical information by anatomist during internship.	38	19	43
5. I think duration of anatomy course is enough.	20	18	62
6. I think anatomy course is sufficient in terms of number.	19	18	63
7. Number of hours of anatomy lectures/theorical classes should be increased.	64	17	19
8. Number of hours of anatomy practical classes should be increased.	25	12	63
9. Associating anatomy lectures with problem-based teaching (PBL) reinforces my learning.	19	20	61
10. Associating anatomy practical classes with problem-based teaching (PBL) reinforces my learning.	15	18	67
11. Anatomy lectures which are supported by clinical data reinforce my learning.	5	8	85
12. Integrated education system has enabled us to better understand the anatomy courses.	15	44	41
13. Cadaver dissection should be performed in anatomy practical classes.	15	12	73
14. The radiological and sectional anatomy lessons should be added to the anatomy lectures.	12	10	78
15. The radiological and sectional anatomy lessons should be added to the anatomy practical classes.	12	10	78
16. If anatomy course be added to the curriculum as an elective course, I will also select the anatomy course, in addition to regular education.	38	20	42

Table 2: *The questionnaire reviews. 1: Strongly disagree 2: Disagree 3: Undecided 4: Agree 5: Strongly agree. Numbers are given as percent.*

It has been stated in many studies that the anatomy knowledge of medical students decrease over time and there are eight factors related with this: 1) Anatomy is taught by teachers who are not medically qualified, 2) The deficiency of a core anatomy syllabus, 3) Decrease in the dissection as a teaching tool, 4) Anatomy is not taught in context, 5) Integrated curricula (systems-based curricula or problem-based learning), 6) The deficiencies in assessment methods in anatomical knowledge, 7) Decrease in anatomy teaching time and 8) Neglect of vertical integration of anatomy teaching [10,11,13-15]. We can also add other reasons for our Country. These are 1) The increase the number of students enrolled at the medical school in recent years along with the increase in the ratio of student/lecturers, 2) Inability to find sufficient medical anatomists as a result of the opening of too many medical schools.

In this context, we tried to answer the following questions in this study. 1) Does the anatomy education model meet the needs of students? 2) Are the hours and content of anatomy courses sufficient? 3) Is anatomy course satisfactory for the medical profession? 4) Is there a need for a vertical integration system in addition to the existing system? Our research is important for measuring the competence level of given anatomy education in various medical schools in Turkey. The study was carried out on people who have successfully completed an anatomy course. Therefore, students had a chance to answer the questions independently without pressure.

In this questionnaire, statement number 1 was "I think that I took adequate anatomy courses for the medical profession. Therefore, it is not necessary to make changes in the curriculum". Majority of the responses to this statement was negative (42%) (disagree or strongly disagree). Thirty-two percent of the respondents strongly agreed or agreed with the statement and there were 26% undecided respondents. Based on these results; there was no significant difference between those who do not want the syllabus of anatomy education to change before graduation with those who want it to change. In order to fit the anatomy education to the current medical training time, various topics can be left out (negligence of sectional, topographic or clinical courses) or the lecturer can change the content of the topics according to their field of study in some medical schools [10].

In addition, we believe that anatomy education needs a standardization planned in accordance with the National Core Curriculum (NCC) for undergraduate medical education. When a literature survey is made, it can be observed that most anatomists agree on having a core curriculum [9-11].

However, consensus on the depth of the curriculum seems too little. For example; is it necessary to know origin and insertion points, functions and nerves for every muscle or detailed information about descending- ascending tracts in the central nervous system? The program and syllabus should be associated with NCC-2014 (as much as possible). This syllabus will provide three things: 1) Anatomists, clinicians, and administrators will be able to control what students need to know and how much they need to know. 2) Students will be able to know what they learn during the anatomy course and how much they need to know (auto-control). 3) It also provides students an easy access to information.

Statement number 2 was "I think anatomy course was a waste of time for me". Majority of the respondents (70%) answered this statement negatively so they stated that the content of the anatomy lesson is useful. Nevertheless, 16% of the respondents thought that the anatomy course was a waste of time and 14% were undecided about it. Anatomy is one of the basic courses of medical education. Therefore it is not possible to learn clinical information without anatomy (especially surgical topics). Doctors/candidates can identify abnormal structures and pathology only after learning the normal formation.

Statement number 4 was "I would like to be taught anatomical information by an anatomist during the internship". Ratios of positive or negative responses to this statement were close (44% positive, 41% negative). We think it may be helpful to teach anatomy lesson in clinical practice by anatomists.

Statement number 5 was "I think that the duration of the anatomy course is sufficient". Most respondents answered this statement (64%) positively. Statement number 6 was "I think that the number of anatomy courses is sufficient". Similarly, the majority of the respondents gave positive answers (64%). We think it would be useful to revise the content of anatomy courses as well as their clinical relevance by making minimal changes to the curriculum. With that in mind, one of the factors stated in relevant literature as a cause for the decline of anatomy information is a reduction in anatomy teaching time. Here are two influential factors: a) Due to the increasing number of students, students are not given enough time especially in practical classes. b) There is a large amount of knowledge and competence to be taught in the medical education curriculum, so the available time for anatomy education has reduced [10,16].

Statement number 7 was "Number of hours of anatomy lectures should be increased". Most respondents gave (65%) negative answers. However, more than half (59%) of the respondents answered gave positive responses to statement number 8, "Number of hours of anatomy practical classes should be increased". 28% of the respondents thought that there is no need to increase the hours of practical classes. 103 second grade students who participated in the practical classes were surveyed in Uludag University School of Medicine. 56.3% of the students thought that practical classes are enough, whereas 43.7% stated that they should be increased [12]. There are 40 and 98 hours (total of 138) of anatomy practical classes in the first and second grades respectively at the Medical School of Uludag University. The total number of hours of practical anatomy classes in our faculty is 120 (52 in the first grade, 68 in the second grade). As mentioned above we believe it would be beneficial to increase the hours of practical classes with minimal changes in the theoric curriculum.

Statement number 9 was, "Associating anatomy lectures with problem-based teaching (PBL) reinforces my learning". 61% of the respondents agreed or strongly agreed with the statement, while 19% of them disagreed or strongly disagreed. Similarly, statement number 10 was, "Associating anatomy practical classes with problem-based teaching (PBL) reinforces my learning". More than half of the respondents (67%) gave a positive response. Both students and trainers are important for the preparation of a successful training program. A team must be created for systematic cooperation. Establishing effective communication for finding solutions to problems and sharing

achievements is one of the factors that make it easy to be successful during educational life. Instead of a one-sided communication similar to the usual lectures of teachers, active learning based on interaction enables the students to have a say on what and how much they need to know. Passive student concept is lost in the student-centered teaching model and the teacher becomes a mentor. This educational model has a two-sided communication and aims to provide the student with skills in research and self-learning. The importance of mutual communication is great on the basis of the student-centered teaching model. Nowadays it is becoming increasingly common [12,17]. However, self-directed learning is not favored as a learning method for anatomy [18], therefore, anatomy lectures should be continued at medical schools.

Statement number 11 was, "Anatomy lectures supported by clinical data reinforce my learning". A large number of respondents (85%) responded positively. Teaching anatomy has a weakness at the point of establishing a relationship with clinical skills, diseases, pathology and radiology in many medical schools. Only classical anatomy lectures are still continued at some schools [10]. The request for giving more space to clinical information reflects students' views on life to prepare for the future. This suggests that there is an interest in clinical anatomy and the existence of such a class could be useful in later grades.

Statement number 12 was, "Integrated education system has enabled us to better understand the anatomy courses". Nearly half of the respondents (41%) agreed or strongly agreed with the statement. A large portion of the respondents (44%) was undecided. In addition, 15% disagreed or strongly disagreed. Each department works independently from other departments in the classical education system (for example, while the physiology department teaches sports physiology and anatomy department teaches anatomy of internal organs at the same time). In horizontal integration; every department teaches the same topic at the same time (for example, both anatomy and physiology departments teach the musculoskeletal system). In addition, each department teaches the same topic at the same time by integrating both clinical lessons with a basic education in the vertical integration system [10].

Statement number 13 was, "Cadaver dissection should be performed during practical anatomy courses". A great number of respondents (73%) answered positively. The important point is that cadavers must be used as a teaching tool. Our goal should be to enrich the teaching of anatomy not only via cadavers but also by way of anatomical models, computers/internet software, application of clinical skills, problem-solving scenarios and so on [10]. It is known that each material has its own advantages. For instance, when 3D models and computers are appropriate for complex structures such as the inner ear and brain anatomy, cadavers and atlases can be sufficient for abdominal organs. The number of cadavers is inadequate and hence, the number of students per cadaver is too high in our country. We believe that allowing importation of cadavers in recent years can solve these problems relatively.

Nearly half of the respondents (57%) gave a positive response to statement number 3 which was, "First and second year anatomy courses should be reminded during the 4th and 5th year at the school of medicine". Furthermore, 33% of the respondents are of the opinion that they do not need to be reminded whereas 18% were undecided. Anatomy education given during the first years is usually forgotten in the following years since it relies on memorization. Therefore, reminder lessons during some clinic internships (especially at the beginning of clinic internships) will be useful in terms of vertical integration [10,11]. We believe that there is a need for vertical integration. Vertical integration within the syllabi is usually uni-directional in many medical schools. While clinical subjects are integrated during the first years of the medical syllabus, it is perceived to be less common for basic sciences to be taught during the later years [10].

There is a small number of publications about the vertical integration of anatomy education [19-21]. Several authors have carried out studies on how anatomy has been vertically integrated into a curriculum. Even though vertical integration is very desirable in anatomy education, it is interesting that the number of studies on this topic is insufficient. In addition, providing vertical integration in anatomy education can help solve some of the problems listed below. 1) Teaching period should be increased. 2) Basic and clinical instructors should cooperate for teaching. 3) Repetition of teaching and learning should be encouraged. 4) More opportunities should be available for teaching in context (e.g. teaching the anatomy that is relevant to a specific clinical rotation) [10,21].

Conclusion

Both anatomists and clinicians agree on the fact that complete and accurate knowledge of anatomy and individual variation is vital for the provision of effective and safe clinical practice. In addition, it is necessary to have full knowledge of anatomy for the development and storage (to be permanent) of clinical knowledge and skills [10,22,23]. However, further research on the vertical integration of anatomy education is needed. In addition, we believe that the anatomy education process should particularly focus on the following issues: 1) Facilities of integrated education (teaching in context) should be increased. 2) Application of vertical integration should be increased. 3) Assessment strategies should be diversified. Moreover, we believe that this improvement in anatomy education in the curriculum needs to be done for other basic sciences as well.

Our goal is to provide a standard education that provides the minimum requirements without uniform medicine and anatomy education. Departments should be able to add their own special training topics, methods, learning outcomes with going beyond the standard curriculum. Establishing specific standards in medical education is a necessity because it makes it possible to evaluate the training program and carry out comparisons between institutions. Establishing such standards also ensures quality training, development, and continuous improvement and it is considered a step [24,25].

Anatomy syllabus in medical schools is taken into account in the preparation of this guide and determination of its content. "Student Study Guide" has been applied at some medical schools in our country and around the world. Examination and consideration of its samples will be important for developing specific standards in medical education. This approach may be an effective way to provide a certain amount of standardization in different educational models applied at different medical schools. However, lack of knowledge in anatomy assessment methods reduces learning anatomy. Anatomy knowledge is assessed mainly by multiple-choice questions with an ever increasing rate at many medical schools [10,13]. Diversification and enrichment of the assessment system will develop not only the knowledge of students but also their ability to analyze the information. Choosing such assessment methods will strengthen the learning of anatomy.

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Conflict of Interest

The authors declare that there are no conflicts of interest.

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