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Research Article

Use of Diagnostic Imaging for the Improvement of Anatomy Teaching and Learning Process

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Abstract

Introduction: In recent years there has been a restructuring of the methods for anatomy teaching with the purpose of updating it. In this study, we aim to know the perception of the students of the Instituto Universitario CEMIC [IUC] about the anatomy teaching methods and the use of diagnostic imaging for understanding and integrating contents, as a contribution to learning.

Materials and methods: From a total of 234 students at IUC School of Medicine, 122 surveys were analyzed. The analysis was carried out with Word and Excel XP programs in order to estimate the frequency and percentage for each question. The answers to questions 1 to 4 were presented as a percentage of students per year and questions 5 to 18 as dichotomous variables (positive or negative).

Results: Most of the students stated that diagnostic imaging are infrequently used in anatomy and that it should be used during the course. Additionally, they consider the study of diagnostic imaging is relevant for clinical practice and should be included in the curriculum. Regarding to the other teaching tools used in anatomy, most of the students affirmed that they are useful. Most students agreed that training with cadavers is relevant for clinical practice and the learning of anatomy, but some of them express some concern.

Discussion: This research aims to study of the current situation of anatomy teaching. Base on the survey results we propose the addition of a diagnostic imaging course to increase its use during anatomy teaching at the IUC. To improve the survey results it could be extended to more students, graduates and anatomy teachers.

Conclusion: Most of the students expressed a positive perception of the learning tools used in anatomy and the value of diagnostic imaging and cadaveric preparations. Therefore, anatomy teaching should be complemented with the use of diagnostic imaging and a dedicated imaging course should be implemented.

Keywords: *Anatomy; Diagnostic imaging; Learning-Teaching; Teaching tools; Instituto Universitario CEMIC*

Abbreviations

PBL: Problem Based Learning; TAS: Task-Assessment system; IUC: Instituto Universitario CEMIC

Introduction

Worldwide, in many Medical Schools, the anatomy teaching is based on traditional methods such as classic lectures, descriptive texts with anatomic figures, clinical cases and hands-on experience with cadaveric material [1].

However, in the last years it has become noted a worldwide trend for restructuring the teaching methods in Medicine, as a result of decrease in the time available for each subject, lack of resources, need to update the teaching topics [2,3] in addition to the technological developments in the healthcare area [4,5].

The variety of teaching methods are the base of the teaching and learning process and has a role both as a communication route and support to stimulate and promote the formation of knowledge, acquire skills and habits that students should develop through this formative process. In addition, the teaching methods should increase the learning motivation, concentration and attention and also increase the effectiveness of teaching itself.

In this way, the physiological functions of sensory organs are used. A greater amount of information is transmitted in less time, which promotes learning, reduces studying hours and encourages the memorization of theoretical and practical contents [6].

At present, there is a strong discussion about the anatomy teaching methods; in general terms, the use of cadavers or pre-dissected material is believed to be the ideal means for the practical learning of anatomy. Some authors argue that the practice of dissection by students is indispensable to correctly achieve such knowledge, however, others consider this type of practice somewhat obsolete and even unnecessary, since the use of modern technologies forces medical students and doctors to prove their knowledge solely based on diagnostic imaging [6].

"Knowledge of anatomy is vital in the initial formation of medicine students. In order to acquire this knowledge, the resource of dissection is indispensable, with the aim that the student has direct contact with the anatomical structures, but it is necessary that, during the development of the practical sessions, the student recognizes anatomical structures through image techniques and audiovisual supported materials, before the dissection of the cadaver", points out Delgado Reyes, L. in his book on Human Anatomy Practices [7].

All the reasons stated above explain the growing need to analyze the different current teaching tools and methods, to include the technological advances in the field to the new generations of Medical and other Health Sciences students.

At a result, numerous research articles have been carried out in order to review the methodology of anatomy teaching through the usage of:

1. Cadaveric material [5]
2. New pedagogical tools such as checklists [4]
3. Problem-Based Learning [PBL] and Case Report Presentations [8]
4. Illustrative images [9]
5. Task-Assessment system [TAS] [10].

However, none refer exclusively to the use of diagnostic imaging.

Teaching in Medical School

Teaching the different subjects in the medical sciences is essential and allow students and future professionals to acquire the technical knowledge providing a complete basis on the health spectrum that will prepare them for their work in the following years.

Each subject has specific theoretical and practical content that requires detailed planning based on the objectives that the student is intended to acquire during the course. Moreover, there are different ways of teaching and learning the core medical science (basic cycle) and then the clinical rotations (clinical cycle) subjects, included in Medical School curriculum. The knowledge provided by different courses can include, based on a pedagogical approach, the transmission of such knowledge both passively and actively; the last one gives the student a better imprint of the subject in their memory for a longer period.

From a research study carried out at the University of Colombia, whose aim was to identify educational practices in the teaching of Medicine and its components, stand out as educational methods the following: master classes, clinical and surgical practices, exposure to real clinical cases, Problem-based learning (PBL) practices, simulation of frequent and real situations of medical practice and laboratory practices throughout the career [11].

Modern pedagogical methods are replacing the traditional idea of a teacher with one that fulfills the role of tutor in which it is understood that they must guide, stimulate and encourage the learning process of the students, motivating their active participation, allowing the reflection and development of a generalized and professional view of the contents that must be incorporated in the different subjects [12].

Regarding the images, Henry Walton, former president of the World Federation of Medical Education, argues: "The medical images are the eyes and the hands of the modern physician. The image is to the twentieth century what the stethoscope was to the nineteenth century. This advanced thinking for that time frame is today a resounding statement that gives meaning to the work done for the benefit of future students, teachers and professionals of the health sciences" [12].

Diagnostic imaging is currently a complementary and essential tool for the clinical practice and therefore are of great value when it comes to taking diagnostic and therapeutic decisions for a patient, which also contributes to the education and training of students in the medical field.

It is also understood that the ability to produce and use the technologies that are seen nowadays in the diagnostic imaging implies great responsibly and a physician should be wise and careful not to fall into the false impression of requesting studies simply because they can, rather than doing so with a critical and analytical view in order to fully comprehend the information provided. This is also true for both the medical practice and for its use as a complement in the teaching-learning process [13].

Regarding how students learn and incorporate information and knowledge during the teaching process, researchers at the California Institute of Technology conducted a research in which they concluded that the brain processes information in various different ways: the left hemisphere is based on logic, numbers and language, while the right one is founded on intuition, the creative process and image recognition and fixation. This information allows universities to educate by focusing on the best and most effective ways of learning that students could have and favor, if exploited and used in a reasonable and logical way, the fixation of the knowledge in memory [14].

The success (or failure) while teaching Human Anatomy depends on the ability of each student to remember and engrave the contents, while also creating an accessible database into their minds, so that, when necessary, it becomes a resource to be used and applied safely and effectively in the future practice.

The traditional model of anatomy teaching is based on the transmission of knowledge and contents from the teacher to the student. Although lately this traditionalist method is being severely questioned since it leads to the construction of erroneous concepts, significant loss of effective time for both parties, an extensive pre-dedication by the teacher in order to prepare these long theoretical-practical classes and the exhaustion of attention for students who make an effort to be able to follow the thread of the explanation in the time that

is usually between two to four hours weekly. From the previously stated reasons, this method undoubtedly leads to the inability to achieve the every previously established target expected to be achieved by the student [15].

This is why the main objective of this research is to analyze the current situation of the anatomy teaching and learning process in IUC Medical School, based on the perception that students have about it, after their experience through the course and the use of different pedagogical tools.

Teaching human anatomy in medical school

Human Anatomy is a fundamental subject to every Health Career and it is integrated into the different educational curriculum in Health Sciences Universities worldwide.

"Anatomy was the beginning of the biological sciences and of course, of the medical sciences" [16].

Beginning in Prehistory and the Ancient Age, it revolutionized the ways of understanding human beings and their biology, also changing how they were studied and the possibilities of treatment. The understanding of the human body, therefore, is vital for anyone who decides to venture into the art of medical sciences [16].

In medical training, anatomy stands out from other core subjects as the first encounter of the student with a human body, compared with other subjects of the preclinical cycle (such as Histology or Biology). As a result, learning and understanding Human anatomy is a mandatory requirement for training students.

It can be divided into several disciplines with different forms of application to the general clinical practice. This explains its importance and demonstrate that as a basic science it is still relevant as an integrative pillar that relates different topics that are intended to be provided in the Medicine School and other Health Sciences.

For example, there are different alternatives for the anatomy teaching and learning based on a research carried out in Costa Rica in 2019 that aims the study of anatomy as an indispensable discipline for patient safety:

- Systemic anatomy: study of the body by systems.
- Topographic anatomy: study of the body by regions.
- Microscopic anatomy: study of tissues and organs with the use of the microscope.
- Functional anatomy: study of the purpose of the structures: their shape and function.
- Surface anatomy: study of the superficial morphology of the body.
- Bioscopic anatomy: study of human anatomy through instruments that are introduced by natural and/or artificial opening.
- Neuroanatomy: study the anatomy of the nervous system.
- Clinical anatomy: study of anatomy with a focus on diagnosis and treatment of pathology.
- Surgical anatomy: study of anatomy with orientation in the area of surgery.

- Applied anatomy: study of anatomy oriented to the clinic.
- Radiological or imaging anatomy: study of anatomy by radiography and/ or diagnostic imaging.
- Pathological anatomy: study of the pathologies of the organs and systems of the human body.

It is recognized that anatomy is a basic science that includes numerous approaches that complement each other and at the same time it is related to other subjects and disciplines.

Therefore, teaching can be developed with a global vision and students can acquire a more comprehensive learning of the study of the human body [16].

It can then be concluded that anatomy is an irreplaceable and fundamental discipline included in the different branches of Health Sciences, that has different approaches to understand and apprehend theoretical and practical contents and strengthen the basic knowledge of other disciplines, integrating several medical knowledges.

Anatomy is a subject that provides the necessary and basics concepts to correlate the human body structures with its normal and pathological functions and this is why a proper teaching and learning process is so important.

That is why it is said that: "The anatomy is to the Physiology, what the Geographic is to History" [16]. The study of anatomy is not simple, particularly to first year Medical School students, beginning their university training path. The correct learning of the of anatomy requires a detailed and new anatomical vocabulary, the development of a specific language that is known as Anatomical Terminology (AT) of universal and very precise quality.

Furthermore, new terminology of the topographic and the movements of the human body must be added.

All this allows the development of skills and competencies by the students that will be used for the rest of their career and practice. But it demands more teaching and learning time, concentration and analysis for the incorporation and fixation in their memory of all this knowledge [16].

Objective of the Study

Main Objective

To know the perception of IUC students about anatomy course teaching methodology and the use of diagnostic imaging for understanding and integrating the contents as a contribution to the learning process

Specific Objectives

- To know the opinion of the students about the use of diagnostic imaging in the anatomy. teaching and learning process.
- To know the opinion of the students about the use of cadaveric material in the anatomy teaching and learning process.
- To know the perception of IUC students about the use of diagnostic imaging in Medical School. To know the most useful methodology according to the experience of the anatomy students.

Development

Medical School Curriculum Study Plan Organization

Basic training and Health Promotion [3 years]

Basic training and health promotion cycle		
1st Year	*2nd Year*	*3rd Year*
Biology Biofisics Biochemistry Maths Medical Psychology I Medicine in Art and Culture English I Informatics Anatomy I Introduction and diagnostic of Health situations Elective subject I	Normal Histology and Embryology I Physiology I Pathological Histology I Microbiology, Virology and Parasitology I Medical Psychology II English II Health Sociology Anatomy II Research Methodology I Clinical practice I Community project Elective subject II	Normal Histology and Embryology II Physiology II Pathological histology II Microbiology, Virology and Parasitology II English III Psychosemiology Medical Anthropology Molecular Biology Preventive practices in Primary Health Attention Elective Subject III

Figure A

Clinical and Surgical Cycle [2 years]

Clinical and Surgical cycle	
4th Year	5th Year
Medicine I Surgery I Clinical Pathology I Clinical Pharmacology I Public Health Neurosciences I Medicine History English IV Clinical practice III Global cardiovascular risk Elective subject IV	Medicine II Gynecology and Obstetrics Pediatrics Toxicology Legal Medicine Clinical pathology II Clinical Pharmacology II Neurosciences II Otorhinolaryngology Ophthalmology Traumatology and orthopedics Senior Health Elective subject V

Figure B

Internal Cycle [1 year]

Annual rotary internship (ARI)
6th Year
General medicine General Surgery Psychiatry Gynecology and Obstetrics Pediatrics Family Medicine Elective subject VI

Figure C

Goals of the Medical Career

Overall Goal

To train medical professionals with a high scientific level who rank the humanistic dimension as the foundation of their professional ethics and that act to promote and recover the health of the community in which they work.

Specific Goals

To train professionals that:

1. Can take care of the comprehensive treatment of their patients.
2. Act as agents promoting the physical and mental health of the community where they practice.
3. Understand the importance of national, regional and local health programs.
4. Internalize ethical and moral principles as the basis of their professional practice.
5. Be able to interact with the different members of the health team with an interdisciplinary attitude.
6. Understand the importance of scientific research to improve individual and communityhealth.
7. Assume the need for continuous training and updating of a high scientific level.

Profile of the physicians that are formed at the IUC

The graduate should have developed:

- updated academic knowledge, based on the best evidence and training in the Methodology of Research.
- skills and abilities required to perform the activities that correspond to it.
- attitudes for their professional performance based on bioethics and a scientific, social, human and anthropological approach and for their self-assessment and education based on adequate training to access available sources of knowledge.
- Understand the health-disease process from the biopsychosocial perspective and be trained in health promotion, disease prevention, emergency care, diagnosis, treatment and rehabilitation of pathologies and be to identify non-prevalent problems and guide them efficiently.
- Consider the cost-effectiveness analysis and cost-benefit of the actions they will carryout.
- Be committed to community problems, trained in the concepts of Primary Health Care as a strategy and trained to implement health programs, execute expertise and integrate interdisciplinary service teams.
- To understand health as an accessible, supportive and equitable right of the population.
- Be trained in the management of resources and implementation of epidemiological concepts, in the management of the patient-

family and community as a therapeutic tool and in considering emotional aspects as part of their task.

- Become involved with the patient and the community and promote respect for life based on the application of ethical, moral and legal principles.
- This profile shows the professional competencies that are considered necessary to develop.
- These competences are then presented in the four dimensions set out in Resolution 1314/2007 of the Ministry of Education, Science and Technology, which sets out the standards for accreditation of medical careers [13].

Human Anatomy at the IUC

At the CEMIC University Institute, the Human anatomy subject corresponds to the Cycle of Basic Training and Health Promotion and is divided in Anatomy I and II.

The teaching of Anatomy I and II is based exclusively on a program that informs the students about the contents that they must acquire during the course and the different methods and recommended bibliography.

The lectures take three hours per week. Divided into anatomy I and II, the course takes a total duration of two years consecutively and correlatively.

The lectures are given by professors and associated teachers, based on the use of audiovisual material using PowerPoint with information and illustrative images from atlas books and videos and/or images with real clinical cases of the Institution.

The IUC has a morgue classroom containing formalized and varnished anatomic preparations performed by qualified personnel that allows students to interact with the material, always under the supervision of responsible and qualified staff and a teaching museum with anatomic preparations that are painted for better visualization of anatomical structures and included within glass containers.

It also has anatomic plastic models that let the students to interact with them and be able to disassemble them for a better understanding of the different anatomical structures and their relationships.

Lectures usually go before practices in the morgue classroom allowing students to review the theoretical content and then incorporate and integrate it using the different materials along with the participation of assistants teachers and associate teachers who intend to both explain the content of the lecture and clear doubts from the students.

During the course, the student has two partial evaluation instances, three recover instances and multiple final examination instances: including theoretical and practical knowledge [17,18].

The contents of the subject include:

Anatomy I:

Musculoskeletal system:

- Upper and lower limb anatomy:

- bones, joints, muscles, brachial plexus, lumbar and sacrum, arterial, venous and lymphatic vascular system.
- Spine, raquis and nape.
- Bone skull.

Neuroanatomy:

- Generalities of the central nervous system, spinal cord, stem trunk, brain, cerebellum, cranial pairs and somatic sensitive nerve pathways, systematization of the spinal cord.
- Senses [vision, taste, olface and audition]
- Hypothalamus
- Neurovegetative system [17].

Anatomy II:

Splanchnology

Cardiocirculatory system

- Heart, mediastinal and large glasses.
- Internal and external configuration of the organs that make up the cardiocirculatory system, vascularization of arterial and venous intrication, lymphatic drainage, intrinsic and extrinsic innervation of the heart [cardionector system].

Respiratory system

- Chest, breast, larynx, trachea, lungs and pleuras.
- Internal and external configuration of the thoracic organs, arterial and venous irrigation, lymphatic drainage and innervation of the respiratory system.

Excretory system

- Kidney, renal excretory system, retroperitoneum, female and male perineum.
- Internal and external configuration of the organs that make up the renal system, arterial and venous vascularity, lymphatic drainage and innervation.

Female and male reproductive system

- Organs, arterial and venous vessels, lymphatic drainage and innervation of systems.
- Differences in the male and female genital system.

Abdomen

- Walls of abdomen and peritoneum, abdominal organs supramesocolic and inframesocolic and liver and bile duct, arterial and venous irrigation, nervous system and lymphatic abdomen.

Pelvis

- Bone pelvis, bladder, bladder cell, periné [17].

The objectives of the subject Anatomy are:

General Goals

Students should:

- Use terminology and anatomical language correctly.
- Know the general organization of the living human body of the living, functional anatomy, imaging anatomy and surface anatomy.
- Understand that anatomy is the base to integrate knowledge of the Training Cycle and Health Promotion.
- Assess the importance of anatomical knowledge in the learning of Medicine.
- Obtain the anatomical bases for integration with the subjects of the Clinic and Surgical cycle.
- Highlight the value of contact with anatomical preparations.
- Integrate anatomical knowledge as a basis for performing semiological manoeuvres.
- Recognize the importance of anatomical knowledge of the different systems of the human body for the clinical and surgical practice.
- Interpret diagnostic studies based on their anatomic knowledge.

Specific Goals

Students should:

- Rank a Normal Human Anatomy as a main subject that integrate knowledge of the cycle of basic training and health promotion.
- Develop the anatomical bases for integration with other subjects from the Clinical and Surgical Cycle.
- Recognize the anatomy of the living, functional, image and surface being.
- Learn about the new contributions of anatomy in science and applied them.
- Recognize the value of contact with anatomical preparations.

- Develop knowledge of the different human systems with practical projection; the identification of structures and correlation with the images obtained by the different techniques of diagnostic imaging and their practical importance in the medical formation.

Model of Materials and Diagnostic Imaging used in classes

Model for the use of diagnostic imaging in classes (Figures 1-11).

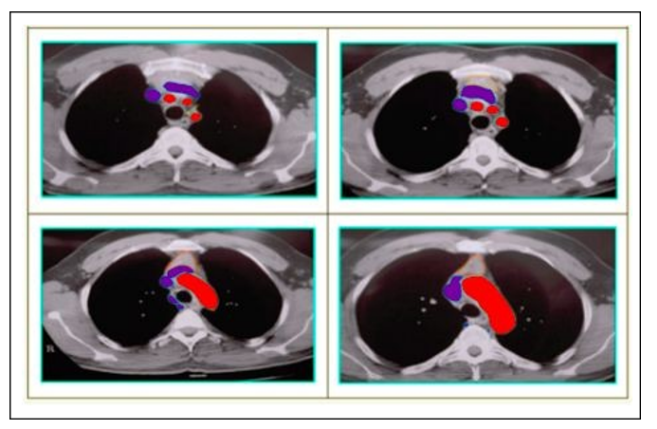

Figure 1: *Computed tomography [CT] of the chest in modified mediastinal window.*

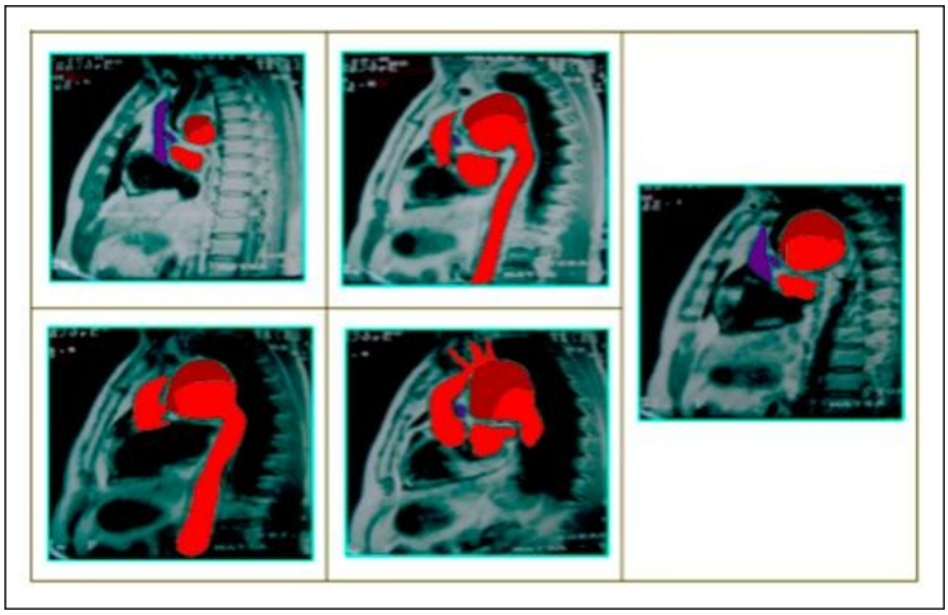

Figure 2: *Computed tomography of the chest with modified mediastinal window.*

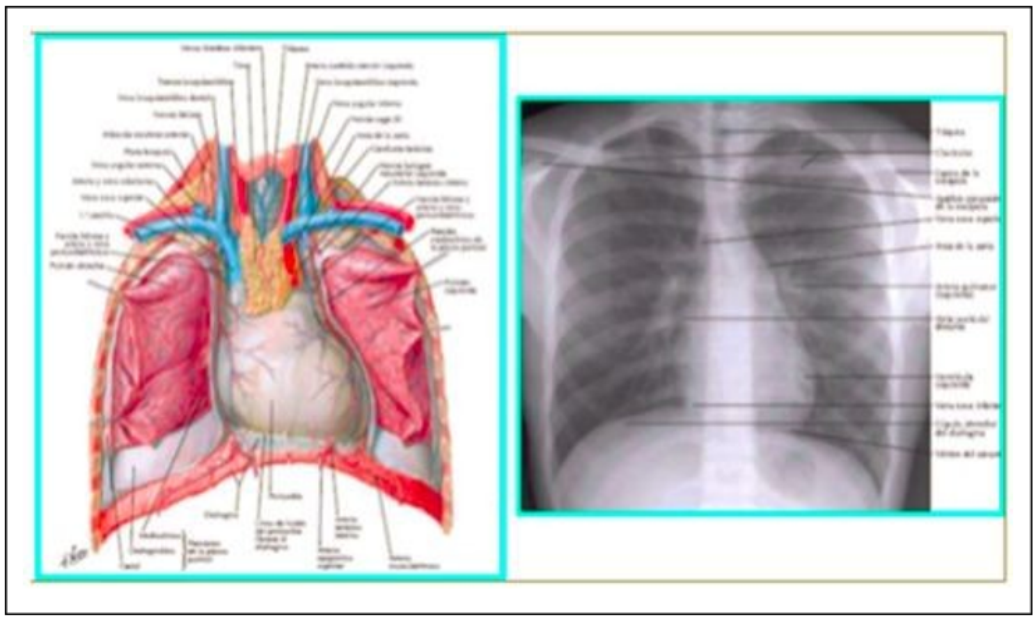

Figure 3: *Chest x-ray with references and comparison with illustrative image of Netter anatomy atlas.*

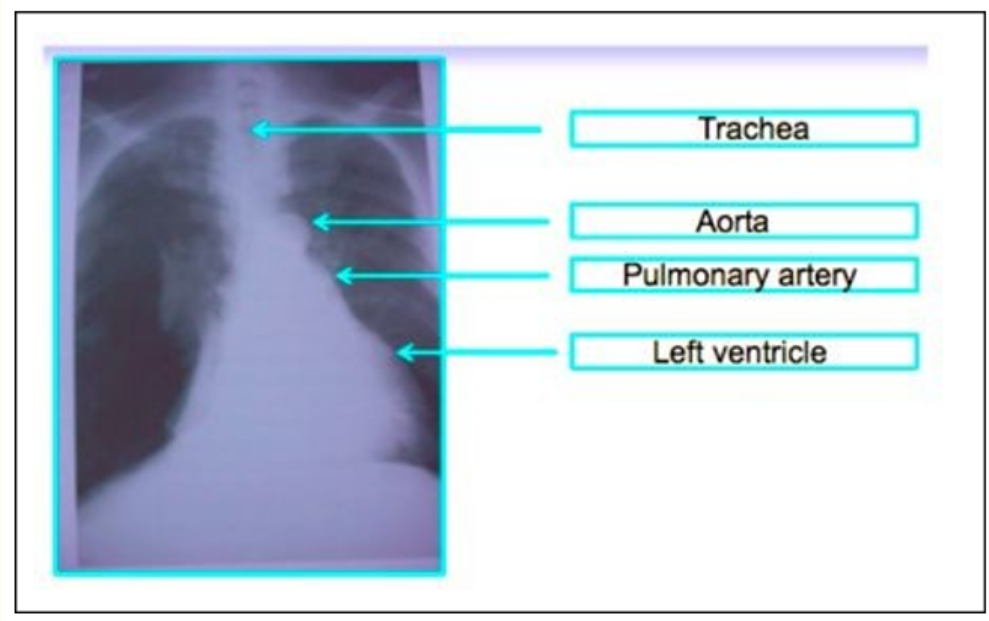

Figure 4: *Chest x-ray with anatomical references.*

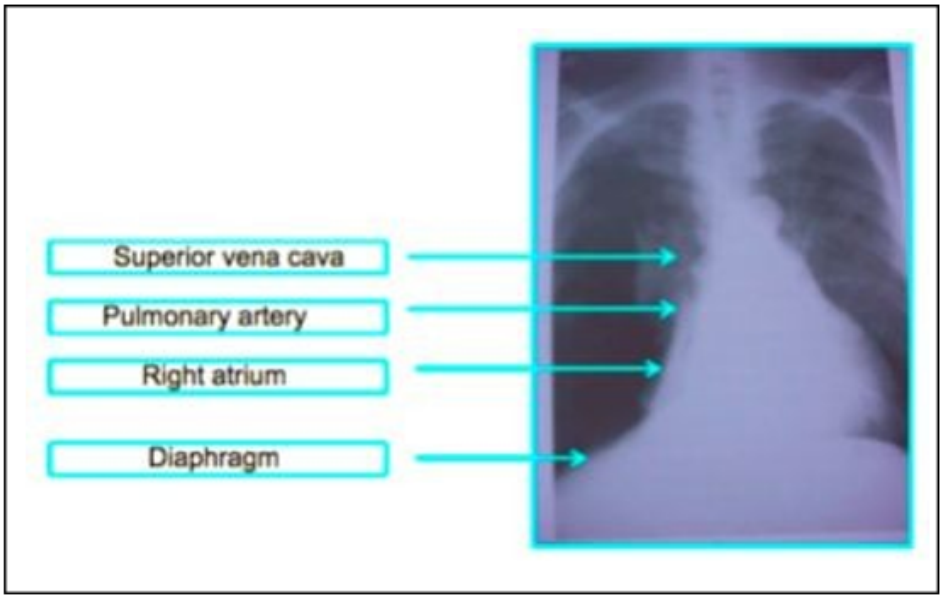

Figure 5: *Computed tomography of the chest with modified mediastinal window.*

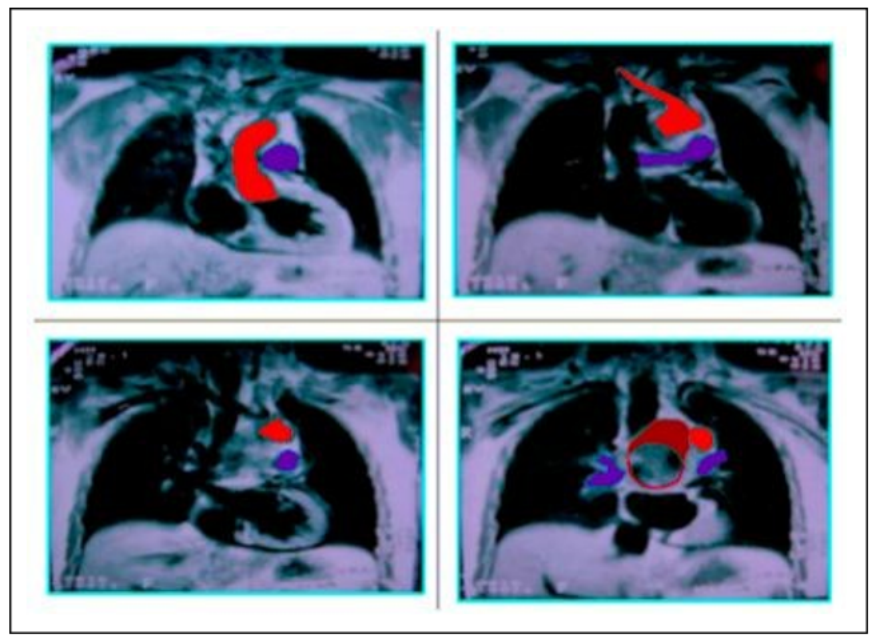

Figure 6: *Computed tomography in modified mediastinum window.*

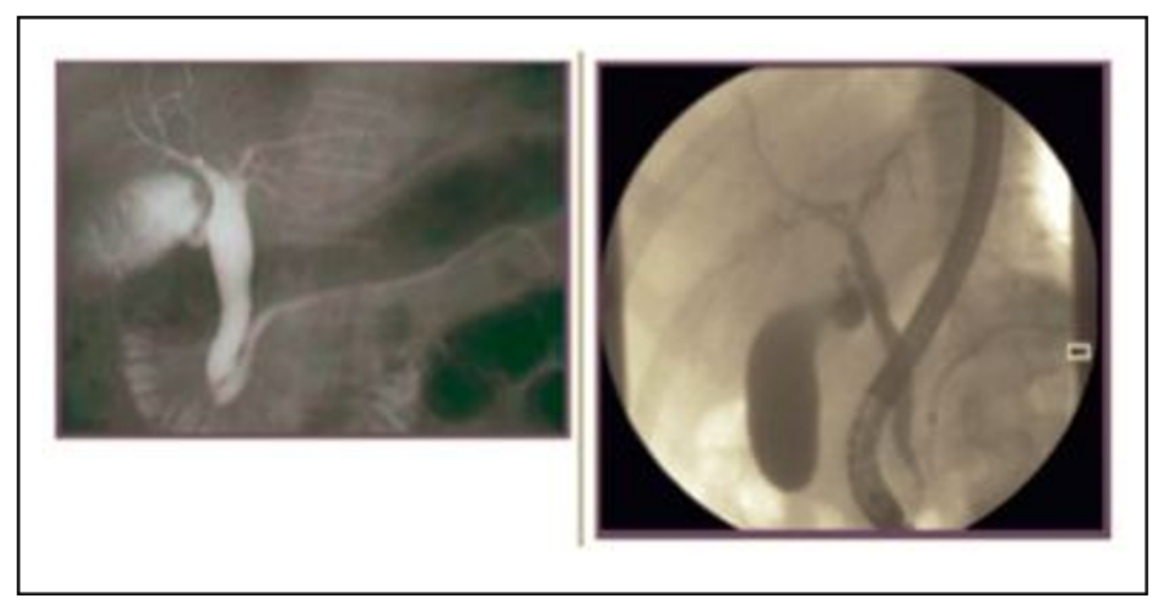

Figure 7: *Cholangiography and Endoscopic retrograde cholangiopancreatography [ERCP] showing gallbladder and bile duct.*

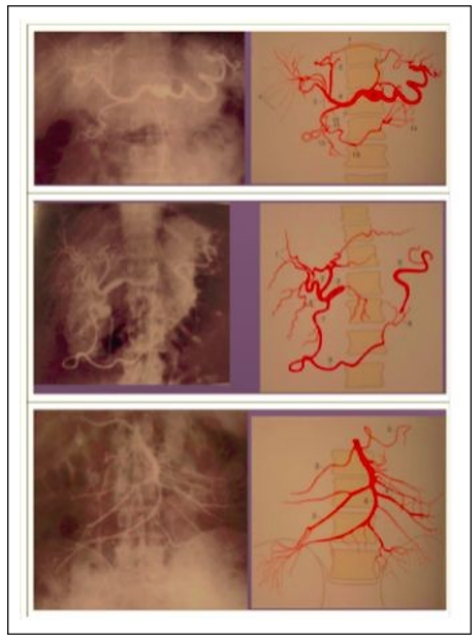

Figure 8: *Abdominal angiography with contrast compared to anatomical references of supramesocolic irrigation.*

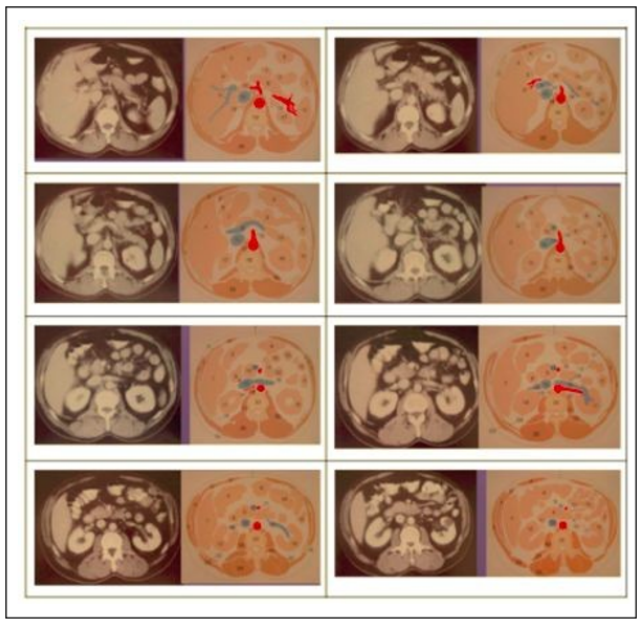

Figure 9: *Computed tomography of the abdomen compared to referenced anatomical illustration.*

Figure 10: *Computed tomography of the abdomen compared to referenced anatomical illustration.*

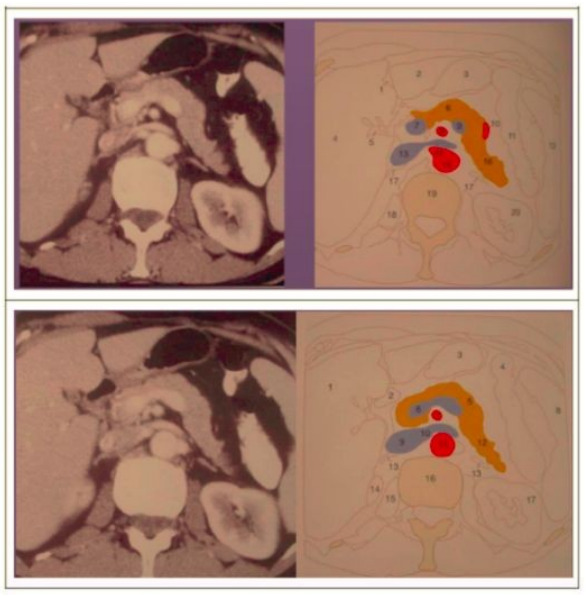

Figure 11: *Computed tomography of the abdomen compared to referenced anatomical illustration.*

Anatomic photographs from IUC (Figure 12-17).

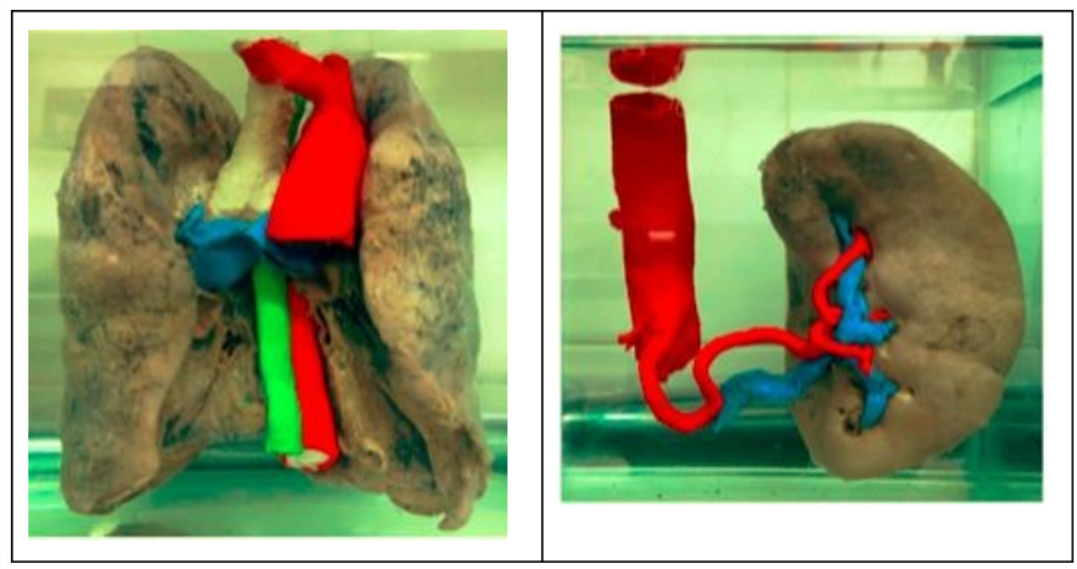

Figure 12: *Anatomic preparations of lungs and large vessels [left image] and spleen along with vascularisation (right image).*

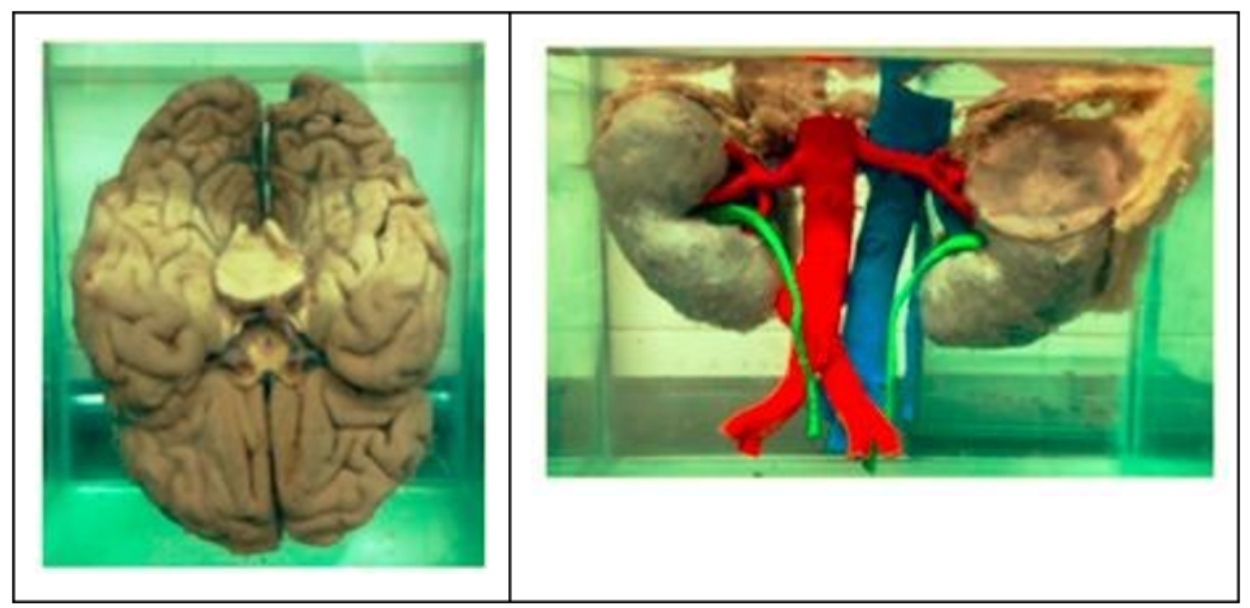

Figure 13: *Anatomic preparations of the bottom view of the brain [left image] and renal system with vascularization and ureters (right image).*

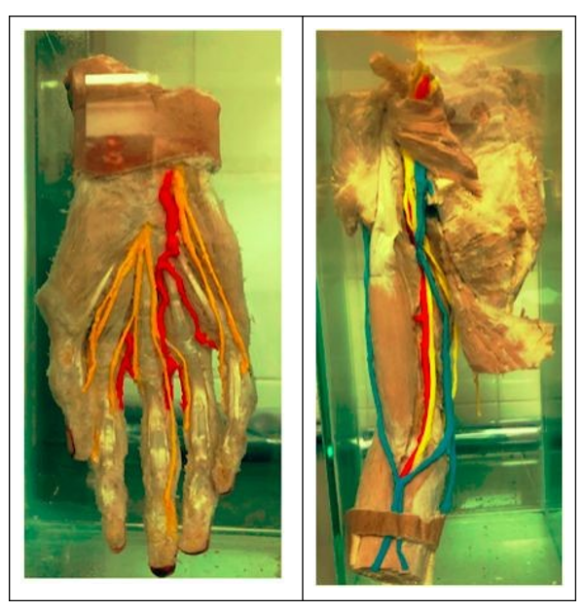

Figure 14: *Anatomic preparations of the hand with innervation and irrigation [left image] and upper limb: muscles, brachial plexus and vascularization (right image).*

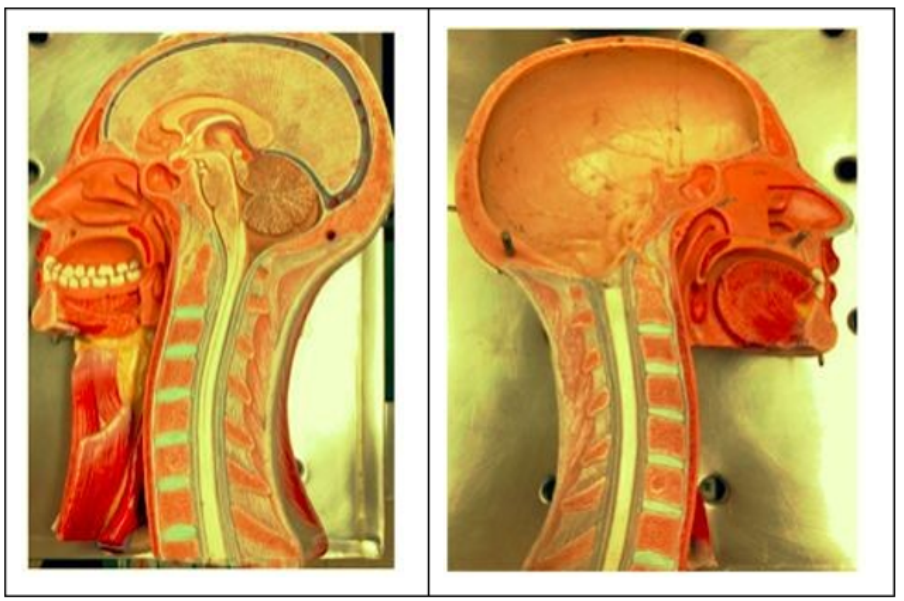

Figure 15: *Detachable illustrative model of face, skull and neck.*

Figure 16: *Detachable illustrative model of trachea and larynx.*

Figure 17: *Illustrative face and neck model with anatomic structures [left image] and digestive system and heart with large vessels (right image).*

Difficulties in teaching

- The time assigned to anatomy is increasingly restricted due to the higher importance given to other disciplines and the increasingly use of technology advances moving the students to set aside the classic descriptive textbooks [4,8,10,19] often outdated compared to modern tools that allow us to interact with knowledge and apprehend it in a different way.
- Most students consider that the anatomy knowledge is so extensive that makes it difficult to learn and that they are not being able to acquire it and ultimately pushing them to memorized it, instead of a significant knowledge that should be apply the to medical practice [10].
- Many of the knowledge acquired during the anatomy course is remembered by the student for a short period of time and, in most cases, forgotten after the completion of the course, if not fixed correctly [4,8,10,19].

As a result of those mentioned aspects, the latest published research has proposed various theories of learning in order to contribute to the development of significant learning in students [2,10].

The failures raised in the classrooms of anatomy with the traditional methodology, generate the need to look for new alternatives that ensure a better quality of learning of this subject by the new students [2].

In addition, the author Luque Bernal believes that the increase teaching based on information and communications technologies [ICTs] in some way manages to remedy the current educational crisis that is presented mainly in the anatomical field.

This crisis was increased by several factors including changes and variety of Universities Programs and curriculum and the decrease in the time devoted to anatomy.

In addition, there is also a sharp reduction in anatomic dissection as a pedagogical tool and the difficulty involved in the acquisition, preparation and maintenance of anatomic material [6].

Benefits of the diversity of methodology and the use of images for teaching - learning

Cadaveric material

Several works include the usefulness of handling cadaveric material [1,5,8,20,21] as a training *of competent,* compassionate and communicative future professionals with a global vision patient's focus [5].

At the same time, it is understood that the use and practices with anatomical preparations allows the recognition and perception of the different characteristics, dimensions, consistency, size and shape of anatomical structures that has a very high value at the time of getting the anatomic knowledge.

It allows the student to approach a real vision of the anatomy that is far from the contents that can be obtain with illustrations, models or photographs of the human body [6].

Checklists

The students who used checklists got higher scores than the control group who did not use checklists. Checklists could be one of many pedagogical techniques that help students in their anatomical learning. [...] checklists were used to improve the learning of medical imaging anatomy, with excellent results [4].

Illustrative images on blackboard and graphic schemes:

- A study carried out in 3 Medical Schools in Mexico showed that students prefer a teaching of anatomy using blackboard images and schemes dictated by professors: A student's preference for the traditionalist method of instruction was found and they choose to receive teaching using blackboard and also a technological approach in the 3 universities surveyed. [19]

- **Task system evaluation**: From the beginning the student is the creator of his own learning and when performing the teamwork, communication between the students is promoted. On the other hand, producing in the student an intentional and objective search [...] is a motivational factor and when he finds what was requested, he will show interest depending on his findings [20].

- The use of learning techniques based on the continuous observation of selected images specifically favors the elaboration of an integrated vision and knowledge, relating not only for anatomy contents but also for other medical subjects: [...] It aims for the student to be able to integrate these images into the anatomic structures that he already knows and to be able to relate it with the contents of other subjects (reflexive observation) [19].

Lastly, it should be noted that due to the disadvantages and difficulties that come with the use and maintenance of formalized preparations, together with the decrease in the time schedule for anatomy, the teachers had to look for other teaching tools such as illustrative models, diagnostic imaging, audiovisual and multimedia programs in 2D and 3D.

However, real anatomic preparations are one of the most pedagogical tools recognized by students and teachers. This alternative is leading to the current crisis that suffers the teaching and learning of anatomy and forces a reflective analysis on the situation [6].

Use, development and benefit of Diagnostic Imaging in the Medicine School

The study of the diagnostic imaging begins in 1895 when the German physicist Wilhelm Roentgen discovers the radiography. From that moment until now, the development and evolution of diagnostic imaging grew exponentially worldwide, together with the technological advances.

Nowadays, modern medicine and clinical practice has a wide variety of procedures and types of imaging studies that brings information to physicians and patients about the normal and pathological anatomy and function of different systems.

The specialist in Diagnostic Imaging and Professor of Diagnostic Imaging of the Faculty of Medicine of the University of Buenos Aires, Dr. José San Román, states in his book "Diagnostic Imaging Manual for students and physicians in training" the following regarding the usefulness of the same in the educational and practical-clinical sense:

The diagnostic imaging is a great complement to the medical history and physical examination. "imaging reach beyond where the eyes can see, or the hand can feel " [Leonard Swischuk]. [...] The diagnostic imaging have come a long way and today the following can be said:

- They provide not only anatomical information but also molecular or functional information.
- They are used for diagnosis and for treatment.
- They are increasingly used to quantify the processes and evaluate the outcome of the treatment.

The various imaging tests have allowed us to explore anatomy and pathology like never before and have improved medicine [23].

Diagnostic imaging has become more important for the study of medicine and the patient's health and disease in recent years [20-22].

The great advance of the last decades in diagnostic technology has brought a major impact on medical practice. The main benefit is the early diagnosis. The disease can be detected even before the first symptoms appear [22].

In addition, the use of imaging gives physicians not only anatomical but also molecular or functional information, allows them to recognize the normal anatomy and identify the most frequent pathologies, among several possibilities [23].

Regarding learning complemented by diagnostic imaging, students could gain competence and gain confidence in their ability to interpret a wide variety of techniques before needing them for clinical use. X-ray, magnetic resonance imaging [MRI] and computed tomography [CT] with anatomic references, help students to become familiar with the two-dimensional anatomical structures, in addition to the three-dimensional vision provided by the cadaveric material [4].

A research of medical students at the University of Colombia in the 2009, suggests: The practice of dissection, the study of diagnostic imaging and problem-based learning, techniques that involve the application of knowledge, were reported as those of greatest interest by students. Research conducted in students of fourth and fifth year of Medical School reported that learning is better through dissection and training with diagnostic imaging [8].

Today, health professionals insist that: Learning to use diagnostic imaging will improve the medicine we practice and clearly benefit patients. [...] It will surely be a better physician if you know how to use the diagnostic imaging correctly [23].

As a new source to improve the study of anatomy we can say that diagnostic imaging and modern technologies include an important variety of possibilities: for example, 3D radiology, computed tomography, magnetic resonance imaging, positron emission tomography, ultrasound and endoscopic methods [6].

It is then understood that the teaching of anatomy in different Medical Schools of the world requires a framing that combines a lot of pedagogical resources, that at the same time complement each other and allow a global vision and multiple approaches based on the different systems of the human body [24].

At present, learning is more concrete and visual, so the use of diagnostic imaging and their multiple variants without doubt increase the motivation and interest of students while favoring attention in a process that is traditionally based mainly on reading [25].

Justification

While there are numerous researches related to anatomy and the use of imaging in the Medical School, none were specifically based on the perception of students as a qualitative-quantitative investigation through a survey or on the use of diagnostic imaging in the subject Human Anatomy.

On the other hand, technological development and the consequent changes that affect the new generations of students lead to new research on the subjects in all careers.

In addition, there are few researches on anatomy teaching and learning process in Argentina.

That is why in this study we propose to know the student's perception, based on their experience during the course on the use of diagnostic imaging and other teaching tools.

In addition, we want to know the opinion of the students about the need to strengthen the use of diagnostic imaging in the Medical Career and on the implementation of a diagnostic imaging course or subject, since currently the ICU Curriculum does not have it.

Materials and methods

A descriptive cross-sectional study with a quantitative approach was carried out to assessed the perception of students of the IUC's Medical Career through a 19 questions survey.

Instrument

10 questions were selected from a questionnaire of 43 questions belonging to the research work On Behalf of Tradition: An Analysis of Medical Student and Physician Beliefs on how To anatomy Should Taught, by Assaf Marom and Ricardo Tarrasch in Israel published in 2015, which were translated (questions No. 11 and 15) and adapted (questions No. 1, 9, 10, 12 - 14 and 18) to the objectives and characteristics of this study.

The rest of the questions were specifically designed according to the particularities of the subject in the IUC.

Survey approaches

The survey is based on five main approaches:

First approach

Collecting basic information about the student: medical school year condition of recurring student, medical residence year or egress from IUC (the last one being an exclusion criterion).

Second approach

To know the opinion of the students about the use of diagnostic imaging in the anatomy teaching and learning process : use of imaging by teachers, experience with the application of diagnostic imaging during Anatomy I and II, employment of diagnostic imaging as a complement to anatomy, which students should use diagnostic imaging, time of the class and the career in which diagnostic imaging should be used. (Questions Nº 5-11).

Third approach

To know the opinion of the students about the use of cadaveric preparations in anatomy: relevance for clinical practice after graduation, restlessness and disagreement with the use of cadaveric preparations and if the learning of anatomy should be based on practices in the morgue laboratory (Questions no 12-15).

Fourth approach

To know the perception of IUC students about the use of diagnostic imaging during the Medical Career: relevance of diagnostic imaging application for clinical practice after graduation and the implementation of a specific subject for diagnostic imaging study (Questions no 16 and 17)

Fifth approach

To know the most useful methodology according to the student's experience in the anatomy course: usefulness of conventional teacher lectures, textbooks, teaching videos, practices with cadaveric preparations and the use of diagnostic imaging for anatomy learning (Question no 18)

Question No 19 calls for an opinion on improvements to the anatomy course which is not assessed in this study.

The questions included multiple choice with a maximum of 10 options, question with a free text answer and ordinals with a maximum scale from 1 to 5 (1 being the lowest value and 5 the highest value).

The respondents had to answer the questions according to their personal experience in the anatomy course and their personal perspective in relation to the subject.

For the survey, the following criteria were used:

Inclusive criteria

Be a regular student of the Medical Career at IUC and have completed all the survey points.

Criteria for exclusion

Do not be a regular Medical Career student at IUC and have not completed one or more survey points.

Study population

183 surveys were conducted from a total of 234 regular students, during 2017 medical year at IUC.

Of the total surveys, 56 [30.6%] were not within the inclusion criteria and were excluded from the analysis. This left a total of 127 [69.4%] surveys.

Of the total number of people who answered the survey and it was accepted, 122 correspond to IUC students and 5 to CEMIC residents who graduated from IUC. However, because of the few cases of the sample these or the last were not analyzed in the final section of the study.

Below is the survey model conducted in print and digital format via e-mail using the SurveyMonkey platform.

Printed survey model

Use of diagnostic imaging for the improvement of the teaching and learning process in anatomy: perception of students, CEMIC University Institute, Buenos Aires.

Survey for students and resident graduates on the use of diagnostic imaging for learning the contents of anatomy I and II at IUC.

We are conducting this survey to evaluate the use of diagnostic imaging in relation to Anatomy I and II, as we consider that the use of diagnostic imaging is fundamental to the physician's job and it is beneficial in anatomy learning.

On the other hand, diagnostic imaging does not have a place within the IUC training curriculum and this should cause difficulties for its understanding.

We ask you to please take a few minutes to answer this form, anonymous and voluntary, taking into account the diagnostic imaging contents based on your experience during the course.

It is very important for us to know the results of this survey, for which we thank you very much for your collaboration.

Introduction

Worldwide, the teaching of anatomy is based on traditional methods such as conventional lectures, descriptive texts, clinical cases and cadaveric preparations.

However, in the last years it has become noted a worldwide trend for a reform the teaching methods in Medicine, as a result of reduction of the time dedicated to each subject, lack of resources, need to update the teaching topics in addition to the technological developments in healthcare.

Main Objective

To know the perception of IUC students about the anatomy teaching methodology and the employment of diagnostic imaging for understanding and integrating the subject contents as a contribution to the learning process.

Specific Objectives

- To know the opinion of the students about the use of diagnostic imaging in the anatomy teaching and learning process.
- To know the opinion of the students about the use of cadaveric material in the anatomy teaching and learning process.

- To know the perception of IUC students about the use of diagnostic imaging in Medical School.

To know the most useful teaching methodology according to the experience of the students in the anatomy course.

Explaining

- The concept diagnostic imaging in this survey refers to computed tomography [CT], magnetic resonance imaging [MRI] and radiography [Rx]; It does not refer to photographs or images of both cadaveric material and atlas books.
- We refer only to the Anatomy I and II subjects dictated in Medical School at the CEMIC University Institute.
- The use of images as a pedagogical tool in this survey makes exclusive reference to the understanding of normal human anatomy, leaving aside any type of pathology or disorder.

First Approach: Basic data of respondents. For IUC students:

1. What year are you in Medical School?

- First year.
- Second year.
- Third year
- Fourth year
- Fifth year.
- Sixth year.

2. Are you retaking the anatomy course?

- Yes
- No

For CEMIC physicians residents:

3. What year are your in medical residency program?

- R1 [First year]
- R2 [Second year]
- R3 [Third year]
- R4 [Fourth year]

4. Are you a physician graduated at IUC?

- Yes
- No

Second Approach: Students' opinions on the use of diagnostic imaging in the anatomy teaching and learning process.

They should be answered by all participants voluntarily and anonymously.

5. As a teaching method, do teachers use diagnostic imaging?

- Yes, often.
- Sometimes.
- No, rarely.

6. In your opinion, what kind of students should use diagnostic imaging?

- All.
- Only those who think that it is necessary.
- None.

7. Evaluate, according to your experience during Anatomy I in relation to diagnostic imaging:

- Bad.
- Good.
- Very good.

8. Evaluate, according to your experience during Anatomy II in relation to diagnostic imaging:

- Bad.
- Good.
- Very good.

9. In your opinion, should the anatomy learning be supplemented with diagnostic imaging?

- Yes.
- No.

10. During the classes, at what time do you think the use of diagnostic imaging is appropriate?

- Before the class.

- During the class.
- After the class.
- During practices at the morgue.
- After the practices in the morgue.
- At no time, they're unnecessary.

11. At what stage of the anatomy learning should the student get in contact with the diagnostic imaging?

- Before studying anatomy.
- During the anatomy course.
- In the following year, after anatomic course
- During the Clinical and Surgical Cycle.
- At no stage, it is not necessary.

Third Focus: Students' opinion on the use of cadaveric preparations in the anatomy teaching and learning process.

12. Please rate the following item from 1 to 5:

[Being 1 not relevant, 2 very little relevant, 3 not very relevant, 4 relevant and 5 being very relevant].

To what extent is it relevant to have practiced with cadaveric preparations for clinical practice after graduation?	Not relevant (1)	Very little relevant (2)	Not very relevant (3)	Relevant (4)	Very relevant (5)

13. In your opinion, should anatomy learning be based on the practices with cadavericpreparations?

- Yes.
- No.

14. How disturbing is for you to use cadaveric preparations?

- No disturbing.
- A little disturbing.
- Disturbing

- Quite disturbing.
- Very disturbing.

15. Do you disagree with the use of cadaveric preparations for any of these reasons?

- Religious beliefs.
- Ethical reasons.
- Emotional restlessness.
- Respect for the human body.
- The smell of formalin.
- Medical reasons such as asthma.
- Chemical toxicity.
- Little motivation.
- Nightmares.
- I don't disagree.

Fourth Approach: Perception of IUC students about the use of diagnostic imaging during Medical School.

16. Please rate the following item from 1 to 5:

[Being 1 not relevant, 2 very little relevant, 3 not very relevant, 4 relevant and 5 very relevant]

To what extent is it relevant to have studied diagnostic imaging for clinical practice after graduation?	Not relevant (1)	Very little relevant (2)	Not very relevant (3)	Relevant (4)	Very relevant (5)

17. In his view, should there be a separate diagnostic imaging course?

- Yes.
- No.

Fifth Approach: Most useful methodology according to the student's experience in the anatomy course.

18. Please rate the following teaching tools in relation to your experience in the course from 1 to 5: [1 being nothing useful, 2 not very useful, 3 not very useful, 4 useful and 5 being very useful]

	Nothing useful (1)	Very unhelpful (2)	Unhelpful (3)	Useful (4)	Very useful (5)
Teacher lectures					
Textbooks					
Teaching videos					
Practices with cadaveric preparations					
Diagnostic imaging use					

19. According to your experience, what would you change from the teaching process of anatomy I and II.

Writing space:

Results

Data collection

The survey was delivered to students in written and digital format via email, using an online survey platform, along with an informed consent.

In addition, a pilot test of the survey was carried out with 3 students of each course to corroborate the comprehension and ease of reading these questions, prior to the general survey used for the analysis.

This research was carried out following the recommendations for biomedical research of the Helsinki declaration of the World Medical Association and through an informed consent to guarantee the confidentiality of the information, in accordance with the Habeas Data Law.

Likewise, the study was endorsed by the Ethics Committee, Research Directorate of the CEMIC University Hospital. [Annexus]

Analysis of the results

The information analysis was performed with Word and Excel XP programs. Frequency and percentage were estimated for each question in the survey.

The answers to questions 1 to 4 on basic student data were presented as a percentage of students per year over the total number of surveys.

In contrast, the percentages of questions 5 to 18 were presented as dichotomous variables, encompassing all the options of each question, according to negative or positive answer in each case:

Question 5: On the use of diagnostic imaging by teachers, the variables "No" and "Sometimes" were taken as negative and "Yes" as positive.

Question 6: on the use of diagnostic imaging by students, the variable "None" was considered negative and "All" and "Only those who consider it necessary" were considered positive.

Question 7 and 8: on the use of diagnostic imaging in Anatomy I and II respectively, the variable "Bad" was considered negative, while "Good" and "Very good", positive.

Question 9: on whether learning anatomy should be complemented with diagnostic imaging , the variable "No" was taken as negative and "Yes" was considered positive.

Question 10: on the appropriate moment of the use of diagnostic imaging in the class, "At no time, they are unnecessary" was the only variable considered negative while "Before class", "During class", "After class" , "During the practices in the morgue" and "After the practices in the morgue" were considered positive.

Question 11: on the stage of learning to get the student in contact with the use of diagnostic imaging during Medical School, the variable "At no stage, is not necessary" was the only one considered negative, while the variables "Before studying anatomy", "During the course", "In the year following the course" and "During the clinical cycle" were considered positive.

Question 12: Regarding the relevance of the use of cadaveric preparations for clinical practice, the variables "Not relevant", "Very little relevant" and "Not very relevant" were considered negative and "Relevant" and "Very relevant" positive.

Question 13: on basing the learning of anatomy on cadaveric preparations, the variable "No" was considered negative and "Yes" positive.

Question 14: regarding the restlessness of the use of cadaveric preparations, the variables "Nothing disturbing" and "Little disturbing" were considered negative and "Disturbing", "Quite disturbing" and "Very disturbing" were considered positive.

Question 15: on the disagreement with the use of cadaveric preparations, the variable "I do not disagree" was considered negative while the variables "Religious beliefs", "Ethical reasons", "Emotional restlessness", "Respect for the human body", "The smell of formalin", "Medical reasons such as asthma", "Chemical toxicity", "Low motivation" and "Nightmares" were considered positive.

Question 16: regarding the relevance of the study of diagnostic imaging for clinical practice, the variables "Not relevant", "Very little relevant" and "Not very relevant" were considered negative and "Relevant" and "Very relevant" positive.

Question 17: on the implementation of a subject for the study of diagnostic imaging the variable "No" was considered negative and "Yes" positive.

Question 18: on the usefulness of the teaching tools, for each option the variables "Not useful", "Very little useful" and "Not very useful" were considered negative, while "Useful" and "Very useful" were considered positive.

Survey results by approaches

The results are summarized according to the five approaches of the survey (see table 1-5) with values expressed in percentage and frequency, according to the classification of the dichotomous variables used.

First approach: basic data on students	
Year	**Students**
10	16 (13,12%)
2°	17 (13,93%)
3°	42 (34,43%)
	20 (16, 39%)
	24(19,66%)
60	3 (2,46%)
Total	122 (100%)

Table 1: *First Approach.*

Second approach: Use of diagnostic imaging in anatomy			
Question	**Positive**	**Negative**	**Total**
	Frequency (Percentage)	**Frequency (Percentage)**	
Use of diagnostic imaging by teachers (No 5)	47 (38,52%)	75 (61,48%)	122 (100%)
Use of diagnostic imaging by students (No 6)	122 (100%)	0 (0%)	122 (100%)
Use of diagnostic imaging in Anatomy 1 (No 7)	53 (43,44%)	69 (56,55%)	122 (100%)
Use of diagnostic imaging in Anatomy II (No 8)	92 (86,79%)	14 (13,21%)	122 (100%)
Learning complemented with diagnostic imaging (No 9)	120 (98,36%)	2 (1,64%)	122 (100%)
Time of use of diagnostic imaging in class (No 10)	122 (100%)	0 (0%)	122 (100%)
Stage of the use of diagnostic imaging Medical School (No II)	121 (99,18%)	I (0,82%)	122 (100%)
Total	742 (88,54%)	96 (11,45%)	838 (100%)

Table 2: *Second approach.*

Third approach: Use of cadaveric preparations in anatomy			
Question	**Positive**	**Negative**	**Total**
	Frequency (Percentage)	**Frequency (Percentage)**	
Relevance of the use of cadaveric preparations (No 12)	112 (91,80%)	10 (8,20%)	122 (100%)
Anatomy based on cadaveric preparations (No 13)	116 (95,08%)	6 (4,92%)	122 (100%)
Concern about the use of cadaveric preparations (No 14)	41 (33,61%)	81 (66,39%)	122 (100%)
Disagreement with the use of cadaveric preparations (No 15)	109 (89,34%)	13 (10,66%)	122 (100%)
Total	378 (77,46%)	110 (22,54%)	488 (100%)

Table 3: *Third approach.*

Fourth approach: Using diagnostic imaging in Medical School			
Question	Positive	Negative	Total
	Frequency (Percentage)	Frequency (Percentage)	
Relevance of diagnostic imaging study (No 16)	117(95,9%)	5(4,1%)	122(100%)
Subject or course to study of diagnostic imaging (No 17)	72 (59,02%)	50 (40,98%)	122 (100%)
Total	157 (64,34%)	87 (35,66%)	244 (100%)

Table 4: *Fourth focus.*

Fifth approach: Most useful methodology according to the students' experience in the anatomy course.			
Question	Positive	Negative	Total
	Frequency (Percentage)	Frequency (Percentage)	
Option I: teacher lectures	93 (76a3%)	29 (23,77%)	122 (100%)
Option 2: textbooks	106 (86,89A)	16 (13.11%)	122 (100%)
Option 3: teaching videos	108 (88,52%)	14 (11,48%)	122 (100%)
Option 4: practices with cadaveric preparations	114 (93,44%)	8 (6.56%)	122 (100%)
Option 5: use of diagnostic imaging	112 (91,8%)	10 (8,3%)	122 (100%)
Total	533 (96,56%)	77 (3,44%)	610 (IN%)

Table 5: *Fifth approach.*

First Approach: Basic data of the respondents [1-4]

A total of 122 Medical School students were surveyed: 13.12% belong to the first year, 13.93% to the second year, 34.43% to the third year, 16.39% to the fourth year, 19.66% to the fifth year and 2.46% to sixth year.

Second Approach: Students' opinion on the use of diagnostic imaging in the teaching and learning process of the subject anatomy [5-11]

Most students (61.48%] responded that diagnostic imaging is not used or only sometimes used by anatomy teachers. However, 100% of respondents believe that students should use diagnostic imaging.

Regarding the use of diagnostic imaging in the anatomy, all students [100%] argue that it should be used; There were no respondents who considered not to use diagnostic imaging.

Regarding the most appropriate time of use, answered: 0.82% before class, 66.39% during class, 20.49% after class and during [5.74%] and after [6.56%] the practices in the morgue.

99.18% of respondents support that diagnostic imaging should be used at some stage of Medical School.

Regarding at what learning stage the student should be contacted with diagnostic imaging, they answered: (2.46%) before anatomy course, (90.98%) during and (1.64%) in the year following the course and (4.10%) during the clinical cycle (4^{th} and 5^{th} year).

Regarding the use of diagnostic imaging during Anatomy I: the majority (56.56%) replied that it is "bad" and 43.44% consider it "good" or "very good"; In contrast, during Anatomy II: 86.79% answered "good" or "very good" and only 13.21% responded "bad."

98.36% replied that anatomy teaching should be complemented using diagnostic imaging.

In summary, 88.54% of the students have a positive perception about the use of diagnostic imaging in the anatomy teaching and learning process.

Third Focus: Students' opinion on the use of cadaveric preparations in the teaching and learning process of the subject anatomy [12-15]

91.80% of students consider that it is "very relevant" or "relevant" to have practiced with cadaveric preparations for clinical practice and 95.08% believe that anatomy learning should be based on practices with preparations.

Regarding the concern generated by doing practices with cadaveric preparations, respondents replied: 33.61% "does not generate any" or generates "little concern" and 66.39% expressed some concern in this regard. However, 89.34% showed agreement with their use.

In summary, 77.42% of the students have a positive perception regarding the use of cadaveric preparations in the teaching and learning process of anatomy.

Fourth Approach: Perception of IUC students about the use of diagnostic imaging during Medical School. [16 and 17]

95.90% of respondents consider that it is "very relevant" or "relevant" to study diagnostic imaging for clinical practice and 59.02 % support the implementation of a diagnostic imaging subject or course.

In summary, 64.34% of the students have a positive view on the use of diagnostic imaging during the medical career.

Fifth Approach: Most useful methodology according to the students' experience in the anatomy course. [18]

Students consider the following teaching tools "useful" or "very useful": teacher lectures (76.23%), textbooks (86.89%), teaching videos (88.52%), practices with cadaveric preparations (93.44%) and the use of diagnostic imaging (91.80%).

Students consider the following tools "not useful", "not very useful" or "very unhelpful": teacher lectures (23.77%), textbooks (13.11%), teaching videos (11.48%) and practices with cadaveric preparations (6.56%) and the use of diagnostic imaging (8.20%).

In summary, 96.56% of the students have a positive vision regarding the teaching methodologies on which the anatomy course is based.

Conclusion

In responding to the general and specific objectives of this research, it can be affirmed that after analyzing the results of the surveys, the students express a positive perception about the use of diagnostic imaging in the anatomy teaching and learning process at IUC Medical School.

Likewise, most students have a positive perception regarding the use of cadaveric preparations in the anatomy teaching and learning process.

More than half of the students have a positive view on the use of diagnostic imaging during Medical School.

Students have a positive view of the traditional learning tools used for the study and teaching of anatomy.In conclusion, it is emphasized that, according to the student's perception based on their experience, the anatomy teaching at IUC should be complemented with the use of diagnostic imaging and that a diagnostic imaging subject or course should be implemented, since currently the IUC does not have one.

Discussion

A cross-sectional study was proposed to identify the student's perception of the anatomy course, expose the benefits and or difficulties of the actual teaching tools and highlight the use of diagnostic imaging to improve teaching.

Although there are numerous research projects based on learning and teaching tools of different subjects at Medical School, there is no one based on the perception of students on the use of diagnostic imaging to improve and complement the traditional teaching, based on the student's perception according to their experience during the anatomy course.

On the other hand, the checked bibliography shows the constant intention to review the teaching tools as a result of the technological changes in medicine, including clinical practice.

These changes are the result of several factors that make teaching anatomy more difficult, including reduction and difficult keeping of cadaveric preparations, increased number of students by the classroom, reduction of the time schedule for anatomy and the technological advances including information and communication technologies (ICTs) applied to teach and healthcare, with the numerous diagnostic studies available today.

After analyzing the results of the survey, it should be noted that although most of the students affirm that they do not disagree with the use of cadaveric preparations, 66.33% said they had some concerns about it.

It could be thought that the generational changes and the way of studying of the new generations students support the idea of reducing the use of cadaveric preparations, although they continue to consider the practices in the morgue classroom are fundamental for the study and understanding of the human anatomy.

Also, most students consider that the diagnostic imaging use by teachers during anatomy course is little or none and opposed to the fact that they believe that diagnostic imaging is relevant or very relevant for clinical practice.

As limitations of the present work we can point out that the number of sixth year students surveyed is low due to the difficulty of sending them the survey, either in writing or online way.

It is suggested to do again the research strengthening the survey including more students, graduates and anatomy teachers from the IUC. Besides, the same survey could be carried out with anatomy students from other Health Science Careers such as Physical Therapy, Nursing, Nutrition, among others.

At the same time, it should be interesting to compare the results of our research with other Universities, both private and public, of similar and different characteristics, domestic or international, in order to generate an expanded the anatomy teaching and learning process with the use of diagnostic imaging and other pedagogical tools.

We suggest the implementation of a diagnostic imaging course, which can be both mandatory or optional and increase of diagnostic imaging use during Anatomy I and II at IUC Medicine School.

Considering the results of this survey, in the coming years it should be proposed to make a modification in the course of Anatomy I and II at IUC, complementing the classic anatomy course with real clinical cases from University Hospital CEMIC with both diagnostic and surgical imaging.

In this way, the aim should be to improve the anatomy teaching and learning process in Health Sciences, dealing with certain current dilemmas related to teaching methodologies that have an impact on both the teaching staff and the students.

Annexus

Sheet I: information sheet and consent model.

Use of diagnostic images for the improvement of teaching-learning processes in anatomy: perception of the students, cemic university institute, Buenos Aires.

Participant Information Sheet

Summary of the research protocol:

Study Title: Use of diagnostic imaging to improve the teaching-learning processes in anatomy: student perception, CEMIC University Institute, Buenos Aires.

Type of research: cross-sectional descriptive study.

Authority responsible for the institution of realization: Dr. Teresita Manzur.

Study centers: CEMIC University Hospital and CEMIC University Institute [IUC]. Responsible researcher: Sofía Cervantes Farías and Jacqueline Martino.

The purpose of the study: Know the IUC students' perception about the teaching methodology in the subject anatomy and the use of diagnostic imaging applied to the understanding and integration of the contents of the subject as a contribution to the learning process.

Inclusion criteria: Be a regular student of the Medical Career at the IUC or a graduate of the IUC resident in CEMIC and have completed all the points of the survey.

Exclusion criteria: Not be a regular student of the Medical Career at the IUC or a graduate of the IUC resident in CEMIC and have not completed one or more points of the survey.

Benefits of the proposed method for the participant: This research work intends to invite the IUC and other institutions to the analysis of the current situation that includes the learning and teaching process of the subject Human anatomy; We propose the intention of a change to enrich and renew it.

Our purpose is to propose improvements in relation to the use of teaching and learning tools to teach theoretical and practical classes in the field.

Data of the responsible investigator: Sofía Cervantes Farías: scervantesfarias@gmail.com Jacqueline Martino: jackiemicol@gmail.com

Data from the Research Ethics Committee of CEMIC: Tel.: 5299-0247, or 5299-0100 internal 2879.

Fax: [54-11] 5299-1580

Office hours: Monday to Friday from 9 a.m. to 5 p.m.

Web: www.cemic.edu.ar/Investigacion

By participating in this research work on a voluntary basis, I record that:

- Potential uses of this work may include the publication of the results in magazines, congresses or related events, but not the data of the participants.
- This work respects the confidentiality of the data obtained and its scope, in accordance with the Habeas Data Law.
- This work adheres to the Declaration of Helsinki and its subsequent amendments.

Signature: Name and Surname:

Acknowledgment

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