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COMPARATIVE STUDY OF TEACHING HUMAN ANATOMY: TRADITIONAL AND VIRTUAL PEDAGOGY

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A DISSERTATION

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DISSERTATION:

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DECLARATION

The dissertation titled “COMPARATIVE STUDY OF TEACHING HUMAN ANATOMY: TRADITIONAL AND VIRTUAL PEDAGOGY” which is submitted for the award of Doctor of Philosophy in Human Anatomy & Physiology at Selinus University of Sciences and Literature, Department of Natural science is my original work. This dissertation has not been presented at any other institution to earn any degree, associateship, fellowship, or any other academic merit before. Materials borrowed from other sources and used in the dissertation have been duly acknowledged and referenced. Articles published out of this study are also my original work. “I do hereby attest that I am the sole author of this Ph.D. dissertation and that its contents are only the result of my readings and research”

Date: 19 May 2020

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According to the famous saying 'practice make a man perfect'. Islam also teaches us to practice what we learn. "Knowledge without action is insanity, and action without knowledge is vanity"

Imam Abu Hamid al-Ghazali.

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(Teacher)

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ABSTRACT

Human Anatomy teaching is undergoing significant changes. Computer-aided learning, including three-dimensional (3D) environments, is one of the new techniques that appeared in the medical curriculum. Touch screen devices are now of great interest in the medical field. (1)

The present study on a comparative study of teaching human anatomy: traditional and virtual pedagogy aims to conclude How should anatomy be taught? And which method is more ideal in teaching Human anatomy in both the medical and paramedical curriculum. This question, dealing with the methods used for anatomy teaching, has always been a sensitive issue since the beginning of medical education.

Overall the aim of the study is to compare the benefits and drawbacks of teaching human anatomy: traditional and virtual pedagogy. The study was carried out by using the following methods in the three different stages.

i. Review of available literature related to the different pedagogical methods in any form of standard publications available both online and from the standard book.

ii. The survey was carried out and 460 results were collected from medical and paramedical students of different parts of the world for their opinions regarding the methodology used in their curriculum.

iii. The survey was also conducted from the subject experts from different parts of the word in which 42 highly qualified Anatomy teaching professionals were participated to give their valued input.

Finally with the available data of previous journal publications were taken into consideration as the traditional methods of teaching review and for the present methods, the opinions of different parts of students and the highly qualified professionals' feedbacks are compared and final results were interpreted as Final conclusion.

PART ONE

INTRODUCTION

INTRODUCTION

Anatomy forms the basis for the practice of medicine. Anatomy is also important for dentists, chiropractors, physical therapists, and all others involved in any aspect of patient treatment that begins with an analysis of clinical signs. The ability to interpret a clinical observation *correctly* is therefore the endpoint of a sound anatomical understanding. (2)

The term ‘Anatomy” Derived from the Greek ἀνατομή anatomē "dissection" (from ἀνατέμνω anatémnō "I cut up, cut open" from ἀνά aná "up", and τέμνω témnō "I cut") (4).

Human anatomy is the scientific study of the structure of the human body. It can be divided into gross anatomy, histology, embryology, and Neuroanatomy. Gross anatomy deals with the structure and positioning of the bones, muscles and internal organs. Histology deals with the organization of cells and tissues. Embryology is concerned with the development of an embryo. Neuroanatomy deals with the localisation of the function of the human brain, the spinal cord and the peripheral nervous system.

1.1. Anatomy teaching:

How should anatomy be taught? This question, dealing with the methods used for anatomy teaching, has always been a sensitive issue since the beginning of medical education. Nowadays, anatomists have some preferences when it comes to this topic. Patel.et Moxham listed their preferences. In descending order, they

prefer to teach with practical lessons using cadaveric dissection, practical lessons using prosection, tuition based upon living and radiological anatomy, electronic tuition using computer-assisted learning, models[3].

1.1.1. Dissection:

Figure 1.1: *Medieval dissection*

Dissection has always been the paradigm of anatomy teaching since the Renaissance.

Cadaveric dissection has always been an essential and regular feature on medical training. The advantages of practical lessons using dissection are now well known. First there is a knowledge acquisition and integration. Students can indeed apprehend the anatomical vocabulary. They become familiar with both the three

dimensional relationships of the anatomy and the biological variation. Secondly, students can acquire new skills. They develop manual dexterity (skill in performing tasks, especially with the hands.), touch-mediated perception of the cadaver, and competence in the diagnostic and training, and they acquire respect for the physical body (McLachlan et Patten 2006) [(3)].

1.1.2 Prosection:

The distinction between the active dissection by students and the observation of dissection has always been clear. Learning by watching is called prosection. Prosection was the mainstay of Renaissance teaching, in the so-called 'anatomy theatres', but dissection came to be seen as a more modern way of teaching than observation [(1)].

1.1.3. Living body:

'Live models were rated superior to using cadavers, especially in demonstrating superficial anatomy and landmarks'; according to (Barrows, Patek et Abrahamson 1968).Real living bodies have already been used for the need of anatomy teaching[(1)].

1.1.4. Medical Imaging:

Anatomy classes can also include images acquired by medical imaging. It is important for the students to familiarize with two-dimensional images to mentally

visualize the corresponding three-dimensional reality. Imaging technologies are always evolving, and it will become less and less expensive to use such tools.

1.1.5. Computer-assisted learning:

Computer-assisted teaching is more often being used in the anatomy labs. It can show how useful anatomy is. With new technologies like Microsoft power point presentations, there has been an explosion of computer based anatomy material that is made available. It can provide the student with an important additional resource. It usually includes anatomical information, but also allows for the user to test his knowledge.

Users can learn at their own rhythm, in a much more relaxed environment. But anatomists and many others insist on the fact that computer-assisted learning will 'never fully replace the intellectual, educational and emotional experience afforded to medical students by cadaver dissection and even prosecution' (Paalman 2000)[(1)].

1.2. Introduction to Pedagogy:

Pedagogy is defined simply as the method, and practice, of teaching. When a teacher plans a lesson, they will consider different ways to deliver the content. That decision will be made based on their own teaching preferences, their experience, and the context that they teach in.

It encompasses:

i. Teaching styles

ii. Teaching theory

iii. Feedback and assessment.

1.2.1. The History of Pedagogy:

The role of 'teacher' can be traced back to Ancient Greece, with Socrates in the 5th Century BC as the keystone of what we now consider to be modern education.

The role of the teacher has developed from the days in Ancient Greece when the slaves would accompany the children to school whilst their masters worked, and the profession of educator grew from there.

Schools appeared in England as early as 597 AD, and it is generally believed that the first school in England was King's School in Canterbury, Kent. Like many of the first schools, King's School had links to the church, and today operates as a public school [(5)].

1.2.2. How did the first schools approach pedagogy?

By 1780, the church responded to the need to educate the illiterate, and Ragged Schools, Parish Schools and Church schools educated those who didn't have the money to send their children to the fee paying schools.

Ragged schools started with large classes of 30-40 students, and were taught to read from the Bible, often orally, as they couldn't be trusted with books. The church schools tended to use the 'Lancaster Method' where the brightest student taught

what they had learnt to his fellow students, each of whom then passed it on, and continued until everyone had been taught[5].

The first formal teacher preparation began in the 1820s with the establishment of "normal schools" in Vermont and Massachusetts [6].

1.2.3. The different teaching styles:

Teaching style is as individual as your own accent: it is a culmination of teacher's background, context, and personal preference. However, when teaching styles are discussed, it can broadly break them down into a few different approaches.

A teacher may use any combination of these different methods, and may change their approach depending on context, teaching phase, and content that they are delivering [6].

1.2.4. Popular teaching styles:

Following types of teaching styles are considered as standard methods of teaching styles which includes:

i. Phonics
ii. Socratic questioning
iii. Project-based learning
iv. The Mantle of the Expert
v. The Montessori Method
vi. Retrieval practice
vii. Teach like a Champion
viii. Dialogic teaching.

1.2.5. Teacher-centered style:

The teacher-centered style puts the teacher as the expert in the classroom, and the students as the novices. The idea of being 'teacher centered' would be supported by the theory behind behaviourism, a concept that came from the work of pedagogical research by Thorndike (1911), Pavlov (1927) and Skinner (1957)[(6)].

1.2.6. Teacher-focussed teaching styles:

The following teaching methods may be found in a classroom where the teaching style is teacher focussed:

1.2.6.1. Lecture:

Possibly the oldest teaching method, the lecture style puts the teacher at the front of the classroom delivering the content, and the students taking notes. Sometimes referred to as ‘chalk and talk’, a lecture could include visual images, written notes on a handout, or a display of key points on a projector or whiteboard.

1.2.6.2. Direct Instruction:

The teacher delivers the content by explaining the concept themselves, rather than relying upon the student discovering the information on their own. They will give examples of what they mean, and what they don’t mean, and check understanding through questioning.

1.2.6.3. Modelling and live modelling:

As the expert, the teacher will model what they expect the student's work to look like. The teacher will use prepared models to dissect with the class, as well as live modelling an answer (actually completing an answer in front of the class using a visualiser). When live modelling, the teacher may also model the thinking process behind the task, and take input from the students.

1.2.6.4. Low-stakes quizzing:

Assessments that are made frequently, and without any impact on the student's final assessed mark, are called 'low stakes quizzing'. These can take the form of multiple-choice or closed-answer quizzes. The teacher would then use this information to inform their teaching, and what sections that needs re-teaching, or correcting.

1.2.6.5. Scaffolding:

Scaffolding can mean providing sentence prompts, mind maps, essay plans, or teacher-led explanations of the thought process behind an idea before the students attempt to write their own response. Types of scaffolds vary depending on the phase or focus of the class.

1.2.6.6. Questioning:

Questioning definitely occurs in teaching styles- however the types of questions used may differ. With a teacher led approach, may find different types of questioning can be used to monitor the student's understanding, and to correct misconceptions.

Examples include cold-call questioning, dialogic questioning, oral-drill questions, open questions, closed questions, and questioning using the Bloom's taxonomy of remembering, applying, and evaluating[6].

1.2.6.7. Self quizzing:

The phrase 'self quizzing' refers to students working independently testing themselves on a topic that they have already covered with a teacher. It involves students testing themselves, either as a homework task, or in an independent task in the classroom.

1.2.7. Some of the most popular teaching theories:

Teaching theories is a proposed explanation of how we absorb process and retain knowledge.

There are many theories about how we learn, and teachers can use these to assist with their planning and modify their approaches to teaching.

1.2.7.1. Bloom's Taxonomy:

Bloom's Taxonomy is one of the best-known theories in education, used to create and classify learning objectives according the level of complexity.

The taxonomy comprises three domains of learning: cognitive, affective and psycho-motor. Skills are ordered in a hierarchy, where each level takes over from the one before.

In principle, the taxonomy promotes higher forms of thinking and supports learning outcomes that focus on depth of learning rather than tasks.

1.2.7.2. Solo taxonomy:

Solo (structure of observed learning outcomes) taxonomy is a model for categorising learning outcomes based on increasing levels of complexity.

First proposed by educational psychologists John Biggs and Kevin Collis in 1982, the model evolved from the principles of Bloom's taxonomy.

Solo builds on the idea of pupils demonstrating skills that increase in terms of complexity as they move up the taxonomy by placing greater emphasis on the learning outcomes and processes involved in developing understanding.

1.2.7.3. Growth mindset theory:

Growth mindset is a theory centered around the belief that intelligence and learning can be developed and improved. If someone has a growth mindset, they have a positive attitude towards learning and their ability to progress and achieve.

Around 30 years ago, psychologist Carol Dweck studied student attitudes towards failure and found that those who were more resilient and not so disheartened by setbacks behaved in a way that led to greater success.

Based on developments in neuroscience at the time, Dweck proposed that learning capabilities could be improved if pupils engaged in the right behaviors for stimulating the brain and building new connections.

Dweck coined the terms “growth mindset” and “fixed mindset”, and suggested that those pupils who possessed a growth mindset and a belief in the potential for their abilities to improve could display these necessary behaviors [(6)].

1.2.7.4. Flipped learning theory:

Flipped learning (sometimes referred to as flipped classrooms) is a pedagogical approach that inverts the traditional method of the teacher leading learning, instead handing responsibility over to the student.

This is a learner-centered approach that involves students being active in, and accountable for, their development. In the flipped-learning scenario, pupils are given materials and tasks prior to a lesson and instructed to work through these independently.

The technique proposes completing what is generally considered more traditional class work at home and extended homework tasks in school.

Although practices involving peer instruction and students assuming the role of teacher have been around for some time, the term “flipped learning” came into use

around 2012 with the work of two science teachers, Jonathan Bergmann and Aaron Sams.

Both were interested in the best way to use face-to-face lesson time with their students and investigated different ways of using independent study (homework) and technology to free up lesson time for deeper and more developed thinking [6].

1.3.1. A historical timeline of Anatomy:

The focus on anatomy in the ancient world began as a way to determine the nature of the soul [7]. Ancient anatomical drawings and sculptures have been found in caves in Western Europe, Africa, Asia and Australia; while the exact dating of such artifacts is uncertain, some are at least 25,000 years old[8]. Notwithstanding of how crude these some of these illustrations are, they represent the evidence that ancient artists had some knowledge of the formation of muscles and viscera concerning to study of anatomy.

1.3.2. History of anatomy in India:

Five thousand years ago, around 3000 BC Indus Valley Civilization flourished on the banks of the river Indus, contemporaneous with Mesopotamian civilization. Medicine was practised by priests, who were considered next only to Kings and the practice itself was a mixture of magic, rites and rituals [49]. Archeological excavations from this ancient period show clear evidence of knowledge of comparative anatomy. There are cave paintings depicting pictures of animals on

which the critical areas are marked. These areas when hit would have killed the animals. So, herein lie the evidences of the first ever lessons in surface anatomy [50].

The post-upanishadic period from 800 B.C. to 1000 A.D. may be considered the "The Golden Age of Indian Medicine". Ayurveda, the science of life (Ayur = long life; Veda = science) evolved during this period and two great proponents of this science existed and practised medicine in India-Susruta and Charaka. Susruta lived two centuries before Christ and was a contemporary of Atreya who was Charaka's teacher. Charaka samhita can be dated back to 1 A.D. The first written evidence of Ayurveda is in the Sanskrit writings of Charaka samhita and Susruta samhita. These two manuscripts form the twin pillars of ayurveda. Both these samhitas devote a complete section "Sarira sthana" to the subject of anatomy [51].

early Indian anatomists divided the body into six parts- the four extremities, the neck and the trunk. The emphasis in Hindu anatomy was given first to the bones and then to the muscles, ligaments and then joints. Ancient Indian anatomists belonging to Atreya-Charaka school counted 360 bones and those of Susruta's school noted 300 bones in the human body. They included teeth, nails, cartilages, the bony prominences and protuberances as separate bones, a fact that accounts for the large number they got [51]. The art and science of medicine was being taught during this time in the great university towns of Nalanda, Taxila and Varanasi (Benares) , the importance of Indian medicine also had a downslide, but

not before it lent its tenets to the Greeks, Arabians and Egyptians in the west and to the Chinese in the east.[49), (52].

1.3.3. The Stone Age (750000–500000 BCE):

Ancient skulls from the late Palaeolithic period have shown evidence of trephining or trepanning (i.e. the process of cutting a hole in the skull) [(9)]. Especially, in some of these skulls demonstrate evidence of new bone formation around the holes, that indicates some of the victims of these primitive rituals survived the procedure [(10, 11)]. Such practices are thought to have been carried out to release 'evil spirits' from people suffering from mental health disorders as well as other physical symptoms, such as cranial fractures or headaches [(10, 11)].Until recent times, similar practices were still being Performed amongst certain native tribes [(12)].

1.3.4. The Ancient Egyptians (3150–332 BCE):

The earliest records indicate that medicine was first recognised as a craft by the ancient Egyptians; medical practitioners were highly thought of, although there is little evidence that these early 'doctors' had anything but a superficial knowledge of anatomy, as demonstrated by their drawings and sculptures [(13)]. Egyptian mummification practices, which required the cleaning of human bodies, did not provide them with an exact knowledge of internal organs [(14)]. Mummification only required a small incision to remove the viscera for the sake of embalming and the priests who carried out the process were not interested in studying the extracted

body organs. Ancient civilizations such as the Sumerians and Babylonians appear to have had equal or even greater ignorance of human anatomy [15].

1.3.5. The Ancient Greeks (500–336 BCE):

The ancient Greeks appear to have made the first real scientific advances in the field of anatomy [16]. It is claimed that Alcmaeon of Croton, who lived in approximately the fifth century BCE, practised human dissection; unfortunately, none of his notes on these dissections have ever been found [17]. Another notable Greek anatomist was Hippocrates, whose elementary anatomical work dates from around 400 BCE. Subsequently, Aristotle contributed much information to the fields of comparative anatomy and embryology; he was the first of the ancient Greeks to dissect animals in a systematic way. His anatomical studies led him to the conclusion that the soul was the life source of the body [7, 18]. With the fall of the Greek empire, some outposts of civilization survived and emerged as centers of learning. A particularly famous one was Alexandria; some of the anatomists from this school—such as its founder, Herophilus of Chalcedon, and his disciple, Erasistratus of Chios—greatly contributed to existing knowledge of the nervous system, blood vessels and lymphatic's [19].

Additionally, Herophilus was the first physician to dissect human bodies and is considered to be the **FOUNDER OF ANATOMY;** he contradicted Aristotle's notion that the heart was the **"seat of intelligence",** arguing instead that it was the brain[16]. However, he was eventually accused by his

contemporaries of dissecting live criminals. His disciple, Erasistratus, believed that the animal form was determined by environmental rather than innate factors, in line with Aristotle's views. Accordingly, Erasistratus introduced the diametric notions of heredity and environment (e.g. nature versus nurture), both at the level of the individual and the species as a whole [21].

1.3.6. The Ancient Romans (670 BCE–480 CE):

Ancient Roman physicians gained much of their anatomical knowledge of the human body by treating wounded gladiators. As the dissection of human bodies was forbidden, ancient Roman anatomists had to rely primarily on animal dissections to further their knowledge [22, 23]. They were therefore limited in what they could learn about human anatomy.

Galen was an experimentalist and investigator who was born in the Greek city Pergamon but later travelled to Romein pursuit of knowledge, where he became a successful practicing physician [24]. Galen is known for his anatomical observations and experimental approaches in emphasizing the interrelationships between function (i.e. physiology) and form (i.e. anatomy). The majority of his anatomical knowledge was based on his dissections of animals, especially monkeys [25].

1.3.7. The Islamic Golden Age (701–1300 CE):

While Europe was in the midst of the Dark Ages, Arabia was a beacon of medical knowledge. Baghdad in particular was a noted haven for scholars who had scattered after the fall of Constantinople [27]. During this era, many notable Muslim scholars made discoveries which provided greater anatomical insight, such as the contributions of Muhammad Al-Razi (862–930 CE) to the field of Neuroanatomy,

Ibn Al-Haytham (965–1040 CE) who provided new insight into optics, Avicenna or Abu ibn Sina (980–1037 CE) who famously wrote the Canon of Medicine and Ibn Al-Nafis (1210–1288 CE) who explained pulmonary circulation, paving the way for William Harvey (1578–1657 CE), many centuries later [28-30].

1.3.8. The Late Middle Ages (1000–1300 CE):

In approximately 1000 CE, an educational revival began in Europe with the foundation of the medical school Schola Medica Salernitana in Salerno. This southern Italian port became the main hub of medical knowledge in Europe, after having imported important translations of medical knowledge from Arab and Muslim scholars [31].

Two centuries later, the University of Bologna, which was initially a law school, incorporated medicine and other disciplines into its curriculum; it is believed that

post-mortems were carried out here, possibly for medico-legal reasons, potentially leading to a revived interest in anatomical dissections to increase knowledge [32]. At that time, Thaddeus Alderoti (c. 1206–1295 CE) was the most active anatomist in this field [32]. The first human dissection manual ever written, the Anathomia corporis humani, was produced by one of Alderoti's students, Mondino de Luzzi (also known as Mundinus), in approximately 1316 CE [33].

1.3.9. The Renaissance Period (1301–1700 CE):

During the Renaissance period, various anatomical sketches of the human body were made by artists like Leonardo Da Vinci and, to a lesser extent, Michelangelo di Buonarroti, Rembrandt van Rijn, Albrecht Dürer and Raphael da Urbino. [Figures 2–4]. These sketches contributed to anatomical knowledge, but were later disregarded with the production of newer updated anatomical drawings [34]. Artists were keen to gain accurate knowledge of the inner workings of the human body, which would allow them to paint and sculpt the body in many different positions. Even though it was banned by the Catholic church, many artists and scientists performed dissections to better understand the human body. However, dissection required readily available bodies and the most readily available subjects for dissection in those days were executed criminals [35]. During these dissection sessions, a professor would read aloud from Galen's works, while a demonstrator attempted to isolate or point to the various body parts mentioned.

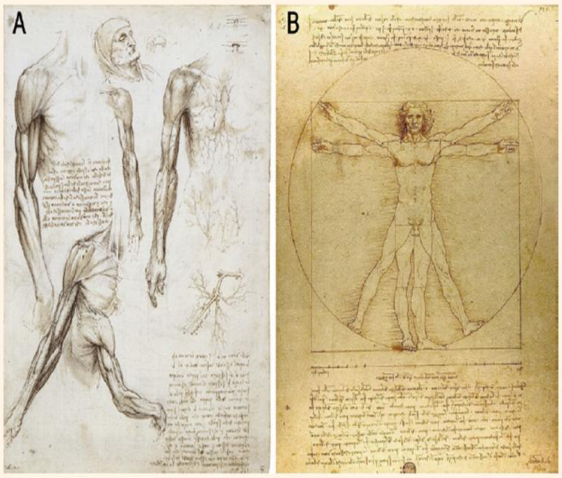

Figure 2 : Pen and ink sketches by Leonardo da Vinci entitled (**A**) *A Dead or Moribund Man in Bust Length* (c. 1487 CE), detailing the muscles of the arm and the veins of the arm and trunk, and (**B**) *The Vitruvian Man* (c. 1490 CE), showing the proportions of the human body.

Reproduced from the public domain.

Figure 3 : Oil painting by Rembrandt van Rijn entitled *The Anatomy Lesson of Dr. Nicolaes Tulp* (c. 1632 CE), demonstrating an educational dissection session.

Reproduced from the public domain.

Figure4: A sketch by Michelangelo di Buonarroti entitled *Écorché* (*Skinned*) (c. unknown), detailing the muscles and anatomical structure of the torso.
Reproduced from the public domain.

In the 16th century, Andreas Vesalius, a student from Brussels who frequently assisted at human dissections, decided to investigate the accuracy of these Galenic concepts and so began to fastidiously record his dissection findings [37]. In 1537 CE, he obtained his doctorate from Padua University, which was the location of the first established anatomical theatre for human dissections; a day after graduating, he was made a professor of anatomy and surgery. Six years later, at the age of 27 years, he completed writing **De humani corporis fabrica** [Figure 5] [38].

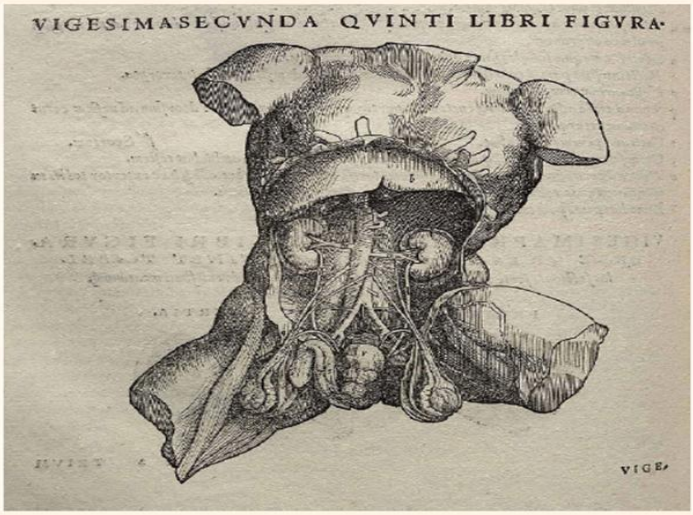

Figure 5 : An anatomical sketch by Andreas Vesalius from the *De humani corporis fabrica* (c. 1543).
Reproduced from the public domain.

This seminal work was a key milestone in the history of human anatomy and was the first illustrated scientific work to evoke astonishment and admiration from the scientific community. Vesalius died in 1564 while on a pilgrimage to Jerusalem. He is credited for raising the field of anatomy from merely a mixture of facts and fiction to an exact science, a fundamental basis of medicine [(39)].

In 1553 CE, Michael Servetus proved that blood flows from the heart, through the lungs and back to the heart; he was burnt alive for this finding, which was deemed heretical by the Catholic Church [(40)].

1.3.10. 17th–20th Century (1601–2000 CE):

Over time, many eminent scientists, physicians and academics have attempted to refine the existing anatomical knowledge available. Their names are often used to

label the anatomical structures or diseases they described, for example: Antonio Pacchioni (Pacchioni's granulations), Antonio Scarpa (Scarpa's fascia and Scarpa's fluid, among many others), Alfonso Giacomo Gaspare Corti (organ of Corti), Filippo Pacini (Pacinian corpuscles), Camillo Golgi (Golgi apparatus), Johann Friedrich Meckel (Meckel's diverticulum), Leopold Auerbach (Auerbach's plexus), Georg Meissner (Meissner's plexus), Ludwig Edinger (Edinger's tract), Heinrich Lissauer (tract of Lissauer), Johann Christian Reil (Reil's finger and the Islands of Reil, among many others), Anders Retzius (Cave of Retzius or Retzius' space), Alfred Wilhelm Volkmann (Volkmann's canals), Franciscus Sylvius (Sylvian fissure and Sylvian aqueduct), François Magendie (foramen of Magendie), Pierre Paul Broca (Broca's area), Charles-Édouard Brown-Séquard (Brown- Séquard syndrome), Jean-Martin Charcot (Charcot disease), Vladimir Betz (pyramidal cells of Betz), William Edwards Horner (Horner muscle), Santiago Ramón y Cajal (interstitial cell of Cajal), Thomas Willis (circle of Willis), Alexander Monro secundus (foramen of Monro) and Sir Charles Bell (Bell's palsy).

These eponymous terms, which are routinely used in medical practice, remind us of the monumental efforts that these anatomists made in the advancement of medical knowledge. Sadly, these names are now being discarded in modern texts and are also often considered to be a nuisance by young medical students. Pioneers who devoted their lives to the science and art of medicine deserve to have their names immortalised. Such great achievements were not easily attained as, more often than not, such important work was performed during times of

religious or political prejudice, repression, superstition, persecution and sometimes even execution [40].

After the development of the microscope by Anton van Leeuwenhoek (1632–1723 CE) and his assistant, Marcello Malpighi, new frontiers were opened up for anatomical research. Van Leeuwenhoek managed to magnify and display the fine details of various

tissues and is regarded as the founder of microscopic anatomy (i.e. histology) [41]. Subsequently, Robert Hooke (1635–1703 CE) was the first to recognized and name cells in the tissues and, two centuries later, Robert Brown (1773–1858 CE) recognised the presence of nuclei [41].

In 1989 CE, following these discoveries, Theodor Schleiden and Matthias Schwann proposed the theory that cells are universal in all tissues, where they play a vital role [41].

This theory is the basis for modern concepts of histology, embryology and pathology. In 1761, Giovanni Battista Morgagni, an Italian researcher, made several discoveries which resulted in him being regarded as the first morbid anatomist or pathologist [42].

Up until the recent past, there was mass hostility towards anyone who carried out dissection practices and it was very difficult to secure cadavers for this purpose [36].

However, with the increasing number of medical schools came an escalating demand for bodies and ‘body-snatching’ became increasingly common. Unless legislation was made to regulate the donation of bodies for medical and

educational purposes, the authorities anticipated that such demands would soon implicitly encourage murder in order for doctors and medical students to obtain the bodies necessary for their research [36, 37].

At the turn of the twentieth century, Abraham Flexner wrote his famous report on medical education and the importance of the basic medical sciences [44]. This highlighted anatomy as an essential science for basic medical training. However, in the years since, there has been an ongoing debate as to how much anatomy education is needed in the medical curriculum [45]. While there are many methodologies for anatomy teaching, the consensus seems to be that the optimal teaching method for anatomy education is to use prosected cadaveric material with other adjunct facilities [46]. This necessitates a continuous supply of cadaveric material. In certain cultures, bequeathal programmes have been founded to regulate body donations to medical schools [36, 47]. Full bodies, body parts and specific organs are maintained using preservation techniques including Plastination and advanced digital imagery, all of which aim to ensure an adequate provision of material for medical students [48].

PART TWO:

MATERIAL AND METHODS

2.1. Background of study:

In many educational areas, a debate continues about the best way to instruct students in order to maximize learning. Anatomy classes face a unique challenge in that they are seen as a foundational course for careers in almost all health science fields. Anatomy classes are often perceived as being filled with endless amounts of terminology and identification, and the conventional mode of instruction has relied on students learning through memorization. With changes in learning theories, some have looked towards modern student-centered methods of instruction that are grounded in modern learning theories such as constructivism in an attempt to go beyond memorization. Many studies on anatomy education that have looked at different types of instruction and student performance have yielded mixed results. No consensus has been reached regarding teaching methods, but there is a silent agreement on the need for students to be able to learn anatomy beyond just accumulating facts [(54)].

In order to move anatomy education beyond the goal of only acquiring factual information, instructional changes should be considered that move toward student-centered instructional environments. The purpose of this is to ensure that the learning environment is more conducive to going beyond the simple facts that may be studied in textbooks and entering a situation where learners focus on understanding and uncovering the reasoning behind the factual information that is normally presented. This may require the instructors of anatomy to be aware of the ideas that students have regarding learning anatomy prior to beginning instruction.

Only a few studies have attempted to describe these ideas, and often student ideas are collected and described after the course has finished [54].

Several anatomy education authors have stated the importance of going beyond a classroom where rote memorization is the primary method of learning (Drake, 1998; Miller et al., 2002). In order to move anatomy classrooms to a more student-centered environment, it may be beneficial to get students to utilize deeper approaches to learning while in the classroom. As it stands now, most students think that one “learns” anatomy through rote memorization and will thus utilize traditional means of memory and drill and practice in order to get a grasp of the material, regardless of how it is presented (Miller et al., 2002; Pandey & Zimitat, 2007).

2.2. Statement of Problem and Purpose of study:

This chapter serves as an overview of the research study that was conducted. It mainly aims to concentrate on “the student’s feasibility on different methods of anatomy teaching”. This study will address the need for describing the ideas that students have about learning anatomy which was included in their curriculum and how good the student able to understand the subject with those methodologies.

For the purpose of understanding the concept of students prospect view the opinion based survey was conducted to study and compare the different pedagogical methodology which were used in anatomy teaching and how the students are willing easily to understand the subject by those methods which were

used in the class rooms, and how convenient these methods for the students to grasp their knowledge in the subject of anatomy.

The student centered survey:

2.3. Source of the Study:

The opinions from different parts of the medical and paramedical schools of different parts of the world is collected, both in developed and underdeveloped countries to roll out the infrastructural facilities if any interferes with teaching anatomy.

This is followed by collecting the data in the form of simple survey circulated to the student with ‘Google Forms’ and the data were collected collectively.

The study will also examine the students’ perceptions about the anatomy class and compare how their ideas regarding learning in anatomy relate to their perceptions. This study will look at different types of anatomy courses that contain students enrolled in the course for a variety of reasons so that In order for anatomy classes to move towards student-centered instructional approaches, teachers must have a good sense of student ideas about learning anatomy and how students perceive anatomy as an academic subject.

2.4. Objectives and method of the Study:

In order to understand the students feasibility point of view, students are asked a simple questioner with multiple methods which compares in which of those

methods are easily adoptable to students to learn anatomy, irrespective of different methods thought during the normal classes and students are able to take decisions regarding the methods of teaching of anatomy, by keeping in the mind the following research questions are asked in the survey to find out the answers for the following question:

1. in which method does the student's perception is of ideal?

2. What are the different types of methods that students like mostly to learn anatomy?

3. How do they feel and comfortable with both cadaveric and non cadaveric study of anatomy?

2.5. The student centered survey:

The student centered survey was conducted by using Google forms in the heading of "Comparative study of teaching human anatomy: traditional and virtual pedagogy" which has three section, and circulated to participate the students from different part of the word from different Medical and allied health courses such as MBBS (Bachelor of Medicine, Bachelor of Surgery), MD (Doctor of Medicine), BDS (Bachelor of Dental Surgery), PT Physical Therapy), MLT (Medical Laboratory Technician), and Nursing students.

2.5.1. Section one:

In section one the questions were asked related to Self introduction to inquire about their personal information in the form of their sex, age, course of their studied, region from where they belongs to etc. Following are of a few questions which are used in section one:

i. Would you like to disclose your identity?

ii. What gender do you identify as?

iii. How old are you?

iv. Please specify your ethnicity.

v. Where is your School/Institute located? vi. In which course are you presently studies?

vii. How long have you been studying with the current school/institute?

These questions mainly aim to collect the data of their region and personal information's.

2.5.2. Section two:

In section two the questions were asked related to the different methods of anatomy teaching which were thought in their curriculum and how feasible of those methods for them to study anatomy.

Following are of a few questions which are used in section two:

i. Have you ever studied the subject 'ANATOMY?

ii. How are you studying anatomy subjects?

iii. Which method among this you like more convenient for Anatomy study?

iv. Please mention in a few words.

v. Can you study Anatomy course without the help of an anatomy lecturer?

vi. Have you ever heard about PLASTINATED SPECIMENS in anatomy?

vii. Have you ever heard about the 3D anatomy visualization system of the Dissection table?

viii. Have you ever operated virtual anatomy dissection with either 3D, 4D, 5D technologies?

The two main object of the section two was to roll-out weather all the teaching methods were using in all the parts of the word such as both traditional and recent methodologies. And how good and how much feasible for the student able to understand and follow those methods' in their curriculum.

2.5.3. Section three:

In section three under the heading Pedagogy the questions were asked related to different methods of teaching more concentrated to newer techniques and with the help of advanced techniques weather they are able to study with or without the teachers classes, how frequently they attend the classes. And over all how good and how much feasible for the student able to understand and follow those methods' in their curriculum.

Following are of a few questions which are used in section.

i. Do you attend, Anatomy Lecturer class regularly in a classroom

ii. Do you agree that you can study anatomy without the help of a regular anatomy lecturer lecture?

iii. What do you prefer?

1. Teacher taking a class using PPT with a projector or LCD
2. Teacher taking a class using Blackboard, color chalks teaching.

iv. How did you feel in an Anatomy Dissection class/Lab?

v. Have you seen/studied Anatomy with Plastinated Specimens in lab?

vi. Compare to Plastinated Specimen with live Dissection with cadaver which one do you prefer for anatomy studies.

vii. Do you prefer to do Dissection or Just Watch Dissection videos on YouTube or any Electronic media?

viii. Compare to Cadaveric Dissection to 3D anatomy visualization system Dissection table, which one do you prefer. And

ix. What is your opinion about anatomy subject survey? Please elaborate in few words.

The main aim of section three is to check the drawback and benefits of the methods used in the recent methodology and how good and how much feasible for the student able to understand and follow those methods' in students prospect view.

2.6. The Teachers centered survey:

Teachers are the experts of the subject; this survey was concentrated from a group of medical field expertise and medical teaching faculty in the departments of Anatomy. From different universities and from different part of the word, and all the participants of survey were having a vast experience in teaching Anatomy for more than 5years.

2.6.1. Objectives and method of the Study:

Survey is designed to aim and gain the opinion from different anatomy teaching faculties to give their philosophy for further improvement of different Pedagogy methods to that of traditional way of teaching Gross Anatomy. In the survey a series of questions were asked respected to different teaching method normally used in anatomy teaching along with different option were provided and suggestion for individual methods were asked.

2.6.2. Source of the Study:

As the role of the faculty member in the modern concept of medical education is to facilitate the learning process. It is important to use multiple techniques in order to reach as many different types of learners as possible. It is observed that curriculum review, teaching methodology, evaluation at institutional level is done by the senior faculty members.

The opinions of subject experts from different part of the word from both Medical and Paramedical faculty were collected in the form of opinion survey, by using Google forms. And the collected data were compared with developed and underdeveloped countries to roll out the infrastructural facilities if any interferes with teaching anatomy. And if any difference were observed due to geographical changes of the student behavior with respect to methodology of teaching anatomy.

The question are made in three aspects which includes, personal information with their total teaching experience and region from where they are working presently, second concern was about which type of teaching pedagogical methods they are using and how good effective with their students satisfaction. And last concern of the survey was what their opinion is? And what were the best methods should be implemented during anatomy teaching in present condition in concern with student's prospect of view.

Following are of a few questions which are used in section.

i. Which country do you work in?

ii. Do you work in a State / (government) or independent Medical School/Medical University?

iii. Which kind of Medical school do you usually work in?

iv. Which designation at present is best suitable for you?

v. How long have you been teaching anatomy?

vi. Which of the following methods do you use in anatomy theory class teaching?

vii. Which of the following methods do you use in your Practical Anatomy classes teaching?

viii. What is your opinion concerning to Cadaveric dissection method in teaching Human anatomy? (Select if applicable more than one):

ix. What is your opinion concerning to Prosected specimen demonstration method in teaching Human Anatomy? (Select if applicable more than one):

x. What is your opinion concerning to Plastinated specimen demonstration method in teaching Human Anatomy? (Select if applicable more than one):

xii. What is your opinion concerning to Virtual dissection table teaching with 3D/4D technology method in teaching Human Anatomy? (Select if applicable more than one):

xiii. In Brief, based on your knowledge what is best method to teach anatomy?

Apart from the main questions all the question as their sub options with multiple selections if applicable to which gives more accurate details about using multiple method if so.

2.6.6. Data Collection Procedures and Data Analysis:

The researcher employed two sets of data collection by using Google form, the first involving a set of surveys that were distributed to different universities from different part of the word and about 460 students of different medical background were participated in the survey and given their valued input which was mainly concerning to ‘Student centered learning aspect of anatomy teaching

methodology'. Separate email invitations were sent to the students for the survey and informing about the study, and these invitations informed students that they could choose to voluntarily for the study.

The second involved a series of data collection was done by using Google form based survey was conducted in where a Experienced professors opinions were collected from different universities from different part of the word and about 42 anatomy highly qualified teaching faculty were participated and they have given their valued input regarding the different teaching methodology used in anatomy.

Separate email / social media invitations were sent to the professors for the survey and informing about the study, and these invitations informed professors that they could choose to voluntarily for the study.

All portions of the data collection process were received by electronic media via Google forms, and thoroughly studied with the help of present and past publication related to the studies of concern, and all the publication that were used in references are collected from highly appreciated and recognised medical and scientific publications from different parts of the word with the final conclusion.

The data being collected consist of both quantitative and qualitative measures, a variety of analysis methods were be used. Quantitative measures include independent variables from the demographic information provided by the participants such as gender, age, race, and ethnicity. The statistical tests were conducted to determine several relationships: the differences within and between each of the participant class groups with respect to gender, age, race, and

ethnicity. Qualitative data from both of the interviews and the surveys were analyzed using the constant comparative method (Strauss & Corbin, 1990).

PART THREE

RESULTS

3.1. RESULTS:

The following chapter presents the results from both the qualitative and quantitative data from this research study. The quantitative data are presented from the results of the Study Process Questionnaire (SPQ) that was administered as part of the Student centered survey and Teachers centered survey. Demographic data from the different classes used in the study are also presented in this section as well as statistical analyses conducted on the quantitative and quantitative data.

In the Students Centered Survey **460 Students** were participated from different part of the word, whereas Teachers Students Centered Survey **42 Professors** were participated from different part of the word. Results were interpreted in the two sections under:

i. Student Centered Results and

ii. Teachers Centered Results.

3.1. i. Student Centered Results:

When the students were asked ‘ would you like to disclose your edntity? Out of 460 students 336(73%) students answered yes for the discloser of their identity, where as 124(27%) of them answered for nondiscloser of their identity.

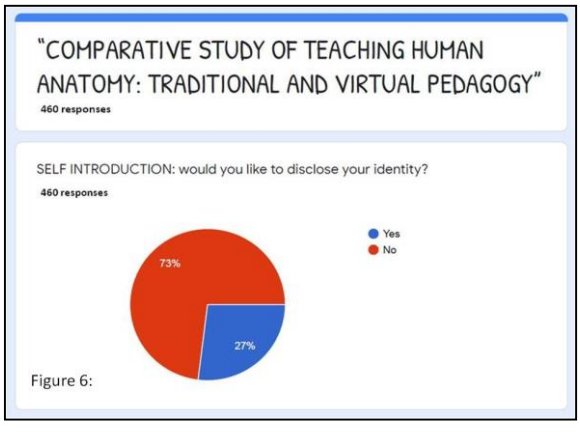

Figure 6:

Table: 1 & Figure 7: Represent the number of students participating in the anatomy student based survey from different parts of the word showing Ethnicity.

Region representing	Number Participants	**%**
Asians	232	55.00 % (+/- 0.5%)
African Americans	80	16.00 % (+/- 0.5%)
(Europeans) Caucasian	24	05.0 % (+/- 0.5%)
Native Americans	04	01.0 % (+/- 0.5%)
Unknown	76	14.00 % (+/- 0.5%)
Prefer not to say	44	09.0 % (+/- 0.5%)
TOTAL	460	100 %

Table: 1

Out of 460 students, 44student (09.0 % (+/- 0.5%) of reluctant to disclose their ethnicity and chosen the option 'Prefer not to say', where as 76 students (14.00 % (+/- 0.5%) chosen the option 'Unknown', 232 students (55.00 % (+/- 0.5%) chosen the option as 'Asians', 80 students (16.00 % (+/- 0.5%) chosen the option as 'African Americans' 24 students (05.0 % (+/- 0.5%) chosen the option as Caucasian (Europeans), and lastly 4 student (01.% (+/- 0.5%) chosen the option as 'Native Americans'.

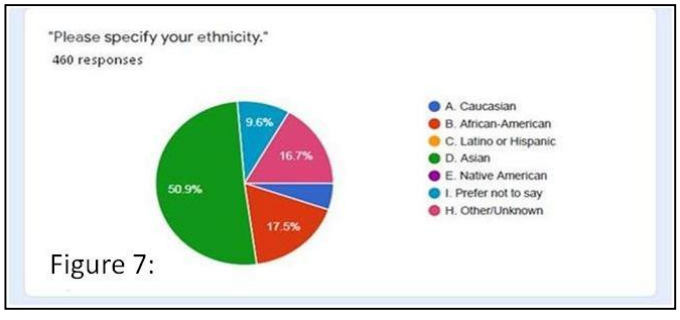

Figure 7:

Concering to their gender out of 460 students majority of them around 236(52.3%) were identified themselves as male gender, and 216(47%) of them are identifived themselves as female gender. Where as 8(1.2%) students not willing to disclose their gender in the survey.

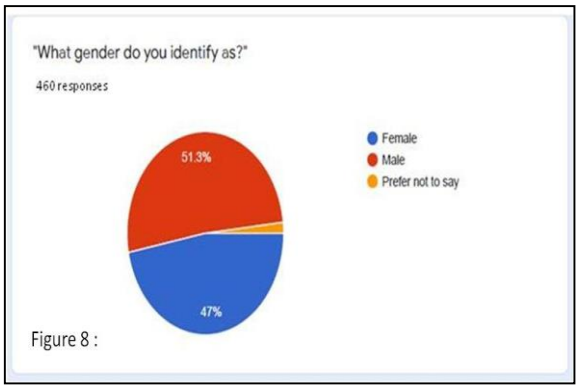

Figure 8 :

Concerning to their age group out of 460 there are about 344(74.1%) students belongs to age group of 18-25 year old, about 72(15.5%) students belongs to age group of 26-35, about 28(6%) students belongs to age group of 14-17 year old, about 16(3.4%) students belongs to 35-45 year age group and about 4(0.9%) students were belongs to above 45 year age group.

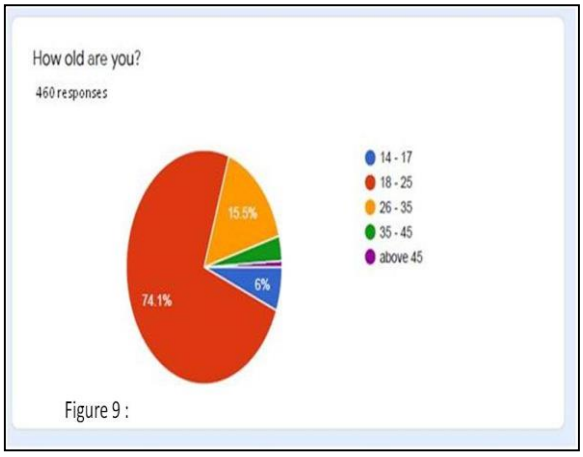

Figure 9 :

As the results concerning to their age group and maturity point of view majority of the students were mature enough to take self decision, with these one of the parameter it can be considered that date collected from the students who is participated in the survey as maximum validity.

Concerning to the location of Schools out of 460 students participated, out of which there are about 244(53.5%) were from different Caribbean Islands, 140(30.4%) from India, 36 (7.9%) from North America/Central America, 20(4.2%) from china, Canada 12(2%) and 8(0.6%) students from the African countries.

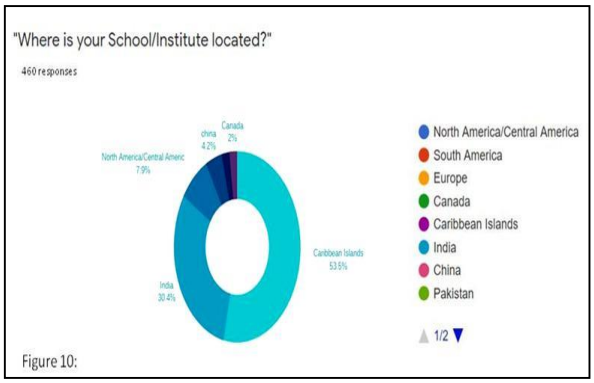

Figure 10:

Concerning to the question 'In which course you presently studies' out of 460 students, Majority of them are belongs to MD (Medicine Doctor) about 236(50.04%), about 216(46.2%) are from MBBS (Bachelor of Medicine and Bachelor of Surgery), remaining about 32(3.4%) participant are from other courses such as BDS, BPT, BOT, MLT and Nursing courses.

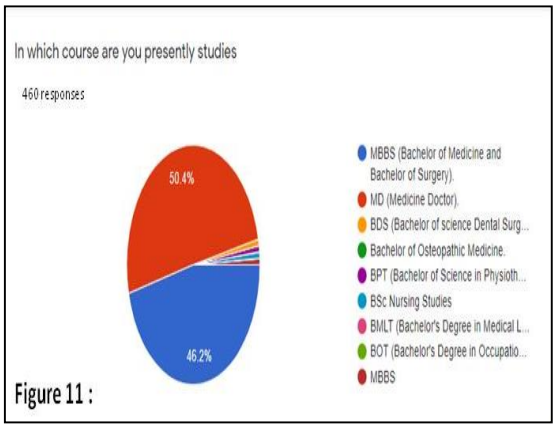

Figure 11 :

Concerning to the question 'How long have you been studying with the current school/institute'? out of 460students about 304(63.9%) studying from last one year, about 124(26.1%) studying from last two years, about 20(4.2%) from last three years and about 12(5.8%) are studying from more than four years.

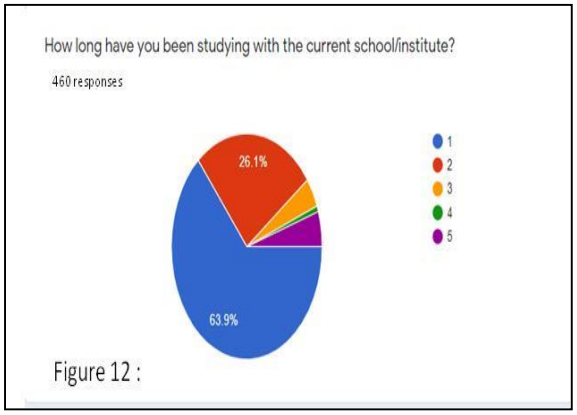

Figure 12 :

From above data it is concluded that most of the students participated in the survey are studying the course from 1-2 years, in most of the medical schools all over the word anatomy was either thought in first year or both in first and second year, as the study full fill the need as most of the student given their opinions during their course of study only.

From the section one survey of 'Student centered result' It is concluded that most of the students participated during their regular anatomy curriculum, and their opinion is have high level of validity, as the participants' represents from different part and ethnicity the survey results will cover all the type of psychological pattern of students with different pattern of their curriculum.

Section second will be mainly concerning about methodological feasibility towards the student's prospect of view how convenient are they with the teaching methods used in their curriculum.

The Second section was conducted under 'PEDAGOGY' heading, in which the first question was asked about do they have knowledge of anatomy before taking survey further. As a result out of 460 students about 432(93.4%) of them answered yes. And remaining 28(6.6%) of the student answered as no, which mostly suggest that this students might be taken recent admissions in course.

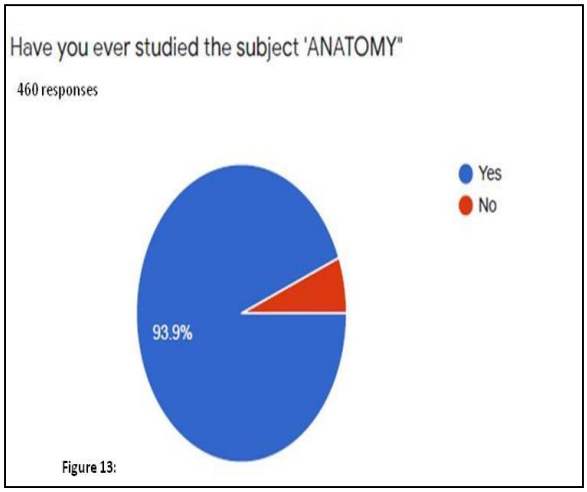

Figure 13:

When concerning to the methodology students were asked ‘Do you attend Anatomy lecturer class regularly in the classroom’ to which 96.6% of students answered yes, 2.6% answered no, 0.9% answered sometimes they attend the classes. From which it can be concluded the survey was genuinely asked to the majority of student who are actively involved in class room study.

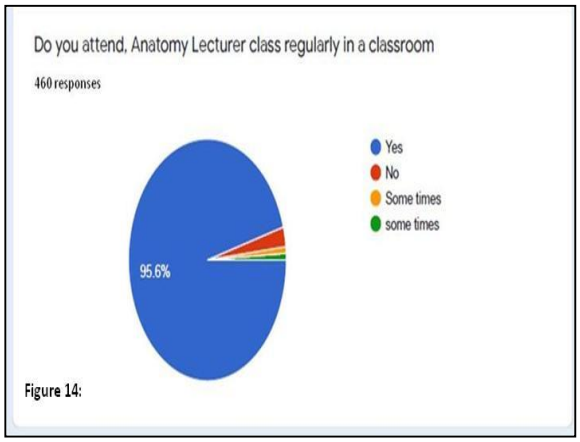

Figure 14:

Concerning to the question ‘How are you studying anatomy subject’ 61.7% of the students answered for the option of “lecture class with Power point (ppt), Dissection with cadavers and specimens.” 33.9% of the students answered for the option of “lecture class with Power point (ppt) & Black board color chalk teaching”. 17.4% of the students answered for the option of “lecture class with Power point (ppt), you tube dissection videos.” 10% of the students answered for the option of “Online lecture class with online you tube videos.”

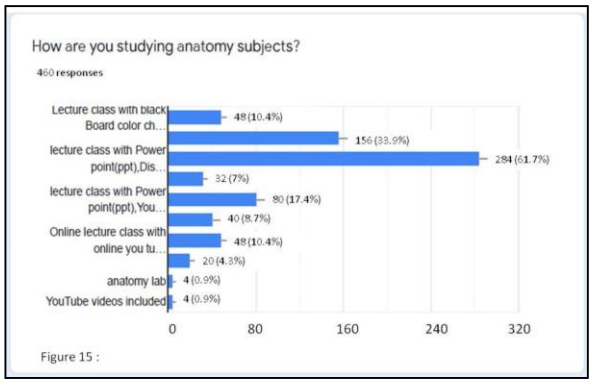

Figure 15 :

As in this section students are allowed to choose more than one option some students chosen multiple options which they used to study apart from the regular

classes. Overall majority of the student prefer "lecture class with Power point (ppt), Dissection with cadavers and specimens".

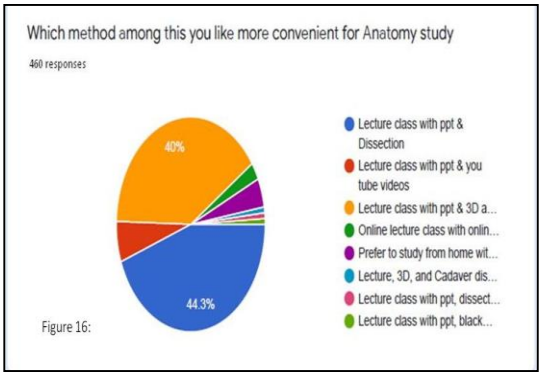

Figure 16:

To rollout the feasibility and convenience of the students compare to advance and traditional way of teaching anatomy following question was asked "Which method among this you like more convenient for Anatomy study" for which 44.3% of the students prefer "Lecture class with ppt & Dissection", 40% of the students prefer "Lecture class with ppt & 3D anatomy visualization system Dissection". 6.1% of the students prefer "Lecture class with ppt & you tube videos' and rest of them 9.6% are interested in self based learning such as online classes, YouTube based video classes and some recent medical imaging based application based teaching.

Over all conclusions for the above question is that most of the students prefer traditional way of teaching which is included dissection and regular classes more preferably Microsoft based ppt. lectures are more favorite among them and they are more feasible.

In addition to the previous question when the students were asked to give their opinion "Why do you choose the above option for anatomy study? Please mention in a few words" following few answers were given by the students to rectify their answers.

Student 1: The best way is to utilize 3D technology to teach anatomy which may not be available in every institution and therefore chalkboard method is best. PPT method is inconclusive and doesn't draw student's attention.

Student 2: I think of myself of a virtual learner, it's easier to recollect structures you see with your eyes and handled with your hands.

Student 3: Because i think education should be interaction and 2 way communicat**i**on between teacher and student.

Student 4: Yes because it's a live dissection and I can visualize the parts directly without the use of 3d images and is kind of less work for my imagination.

Student 5: Dissection helps you put your knowledge into play and get a better understanding of the human body. Seeing is believes.

Student 6: Because in a broader spectrum natural examples register faster than virtual ones.

Student 7: in dissection we feel the structure.

Student 8: Bcz online classes are more clear and understandable and i think we don't have better dissection lab r cadaver to see appropriate structures.

Student 9: I would like to learn with a tutor because I feel we would learn more if we are with an experienced lecturer.

Student 10: Anatomy is very important subject for medical student. With this subject we can learn about the human body.

Overall impression suggest that even though the student are interested in all the recent methodology for visualizing the anatomy structures with 3D and 4D

impression bout for the sake of learning anatomy they prefer to learn with the help of Tutors and dissection, which they feel more convenient for them to understand better.

In the third section of “Student centered survey” researcher tried to find out the students point of view which concerning about different recent methodology used in present teaching trends. In this section more than one option were given to select for their choice of study and questions were asked to find out which method is more feasible and more adaptable for the students.

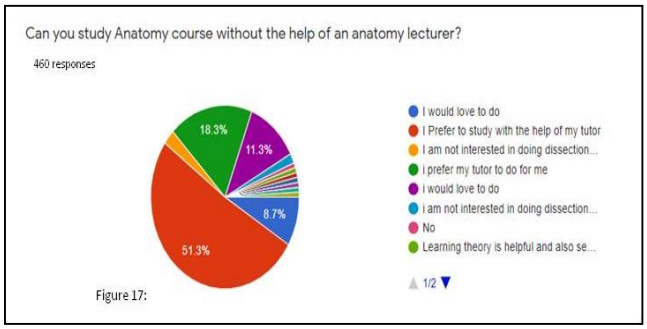

Figure 17:

By using a recent methodology weather students are able to study independently or not students were asked “can you study anatomy course without the help of an anatomy Lecturer?”, in response to which 51.3% of students chosen the option ‘I Prefer to study with the help of my tutor’, 20.0% of students chosen the option ‘I would love to do’,2-4% of the students are more chosen for options like, Lecture note, exam point of view an important question discussion. Reaming students about 24% chose ‘i prefer my tutor to do for me’. With overall impression suggest even though in the advanced technology available students are still dependent on the lecturer classes may be not 100% but in few aspect of their study.

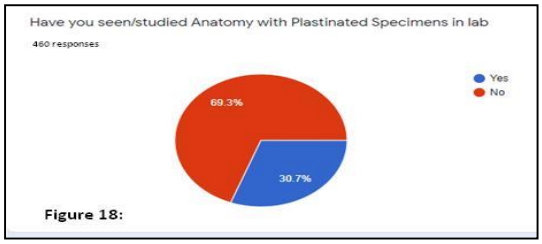

Figure 18:

Students were asked about one of the recent technology used in preserving cadavers as are they aware of the technique for study of anatomy as ‘Have you seen/studied Anatomy with Plastinated Specimens in lab’ 69.6% of the student have never come across the technique and chosen as ’no’ option, 30.7% of the student were chosen as ‘yes’ option. With overall impression suggest even though in the advanced technique looks like not yet reached in most of the medical schools and still they were practicing the older methods more, gradually recent techniques were also introducing slowly.

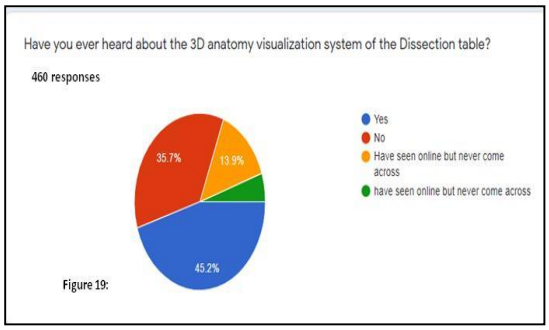

Figure 19:

Related to a very advanced technology students were asked ‘Have you ever heard about the 3D anatomy visualization system of the Dissection table?’ 45.2% of the students were chosen option ‘yes’ as they were aware of the technology,35.7% of the students chosen as ‘no’ option and 19.1% of the student chosen ‘Have seen online but never come across’. Again with overall impression suggest even though in the advanced technique looks like not yet reached in most of the medical schools and still they were practicing the older methods more, gradually recent techniques were also introducing slowly.

Much more advanced related to 3D, 4D & 5D a question has been asked as ‘Have you ever operated virtual anatomy dissection with either 3D, 4D, 5D technologies?’ 77.2% of the students chosen ‘no’ option, 10.5% chosen ‘yes’ and 12.3% chosen ‘Partially seen not operated’ overall impression suggest when it comes to the advance technology and advance methods of teaching anatomy still students are not comfortable, they prefer to study with both traditional and recent methodology only.

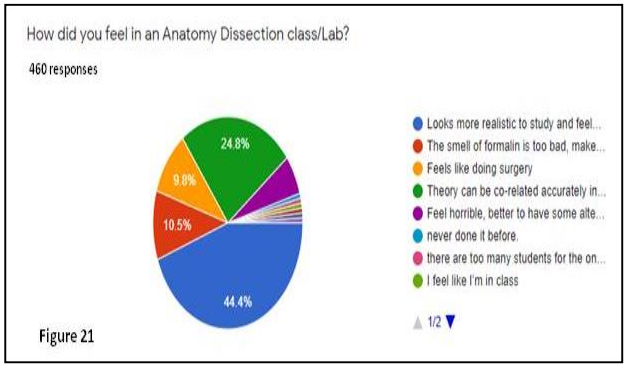

Figure 21

In the last part of the survey students were asked 4-5 questions related to compare the methodologies which were used both in practical laboratory and in pedagogical classes. The main aim of comparative question are mainly related to how exactly they feel physically and when they involved in practical classes and how feasible pedagogical methods to them in theory classes.

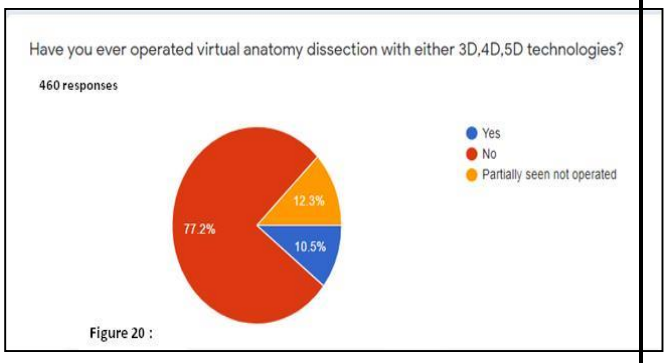

Figure 20 :

As part of the comfort and convenience when students were asked ‘how do you feel in Anatomy Dissection classes/Lab, 10.5% of the students were opted for the option ‘The smell of formalin is too bad, makes irritating’, 6.0% of the students were opted for the option ‘Feel horrible, better to have some alternative methods.’, 9.8% of the students were opted for the option

‘Feels like doing surgery’, 24.8% of the students were opted for the option ‘Theory can be co-related accurately in lab with cadavers’, 44.4% of the students were opted for the option ‘Looks more realistic to study and feel realistic’, rest of the student about 4.6% chosen different answers.

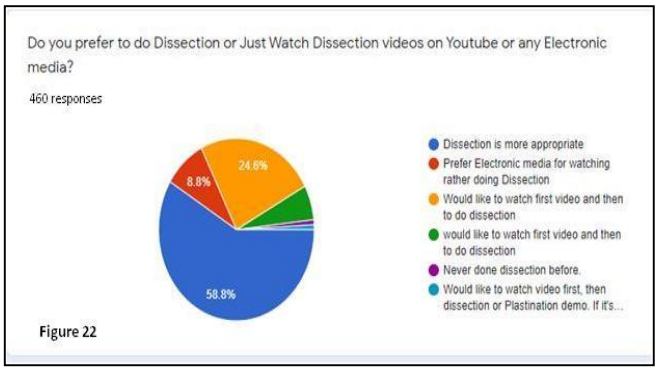

Figure 22

Overall response shows even though some students feel discomfort due to formaldehyde exposure, in spite they would like to spend time in anatomy laboratory.

When students were asked concerning related to active participation in the lab as ‘Do you prefer to do Dissection or Just Watch Dissection videos on you tube or any Electronic media?

Only 8.8% of students chosen the option ‘Prefer Electronic media for watching rather doing Dissection’, 58.8%of the students chosen the option ‘Dissection is more appropriate’ and they would like to do dissection, 24.6% of the students like to do dissection and prefer before dissection they would like to watch on you tube. Rest of the students about 7.7% are happy with both just watching you tube or doing dissection. Main conclusion suggests that majority of the student love to do dissection except very few are not interested.

When students were asked alternative of dissection to with Plastination method as ‘Compare to Plastinated Specimen with live Dissection with cadaver which one do you prefer for anatomy studies. 43% of the students opted for ‘Dissection is better as it gives realistic approach.’ 33.6% opted for ‘Dissection is better as it gives hands on practice for surgery also’, 8.8% opted for ‘Plastination is better, but it will not help in hands on practice.’ 7.0% opted for ‘Both are same.’ As for the student reply it suggest that most of the student were interested in dissection which cannot be replaced by Plastinated specimen, even though Plastinated specimen is easy to handle but students lack the skill work learning by adopting Plastinated specimens.

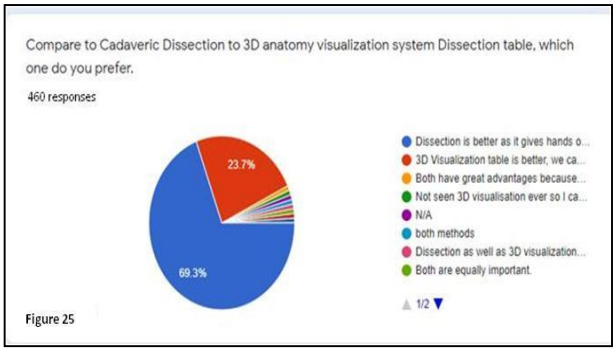

Figure 25

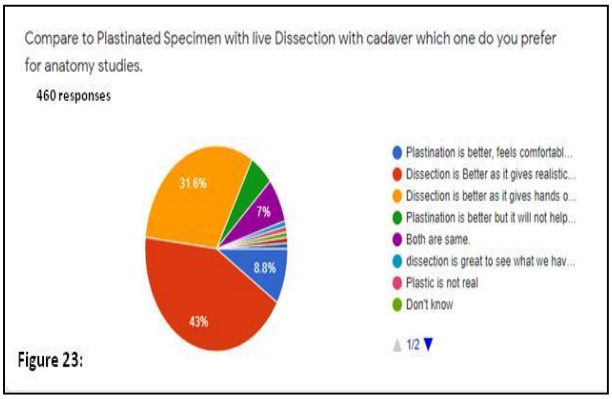

Figure 23:

Related to gadgets used in anatomy students Were asked ‘Compare to Cadaveric Dissection to 3D anatomy, visualization system Dissection table, which one you prefer’, 69.3% opted for ‘Dissection is better as it gives hands on practice for surgery also.’23.7% opted for ‘3D Visualization table is better, we can see everything in an minimal time and can be

zoomed in and out of the structures', around 2-4% are cont able to judge them self, 3% of the students reluctant to give their answer.

As more than 70% of the students view suggest advanced technology cannot replace the traditional dissection method, for several reasons.

3.2. ii. Teachers Centered Results:

This survey is designed to aim and gain opinion from medical field experts of different part of the word to give their philosophy for further improvement of methodology of different Pedagogy to that of traditional way of teaching GROSS HUMAN ANATOMY. This survey was conducted by using platform of 'Google forms', separate mails and invitation on different Medical social Medias such as Research gate, LinkedIn, Academia, etc. were circulated among known medical faculty those who are presently working in the department of anatomy. **About 42** highly qualified Anatomy faulty were participated to give their opinion from different part of the word of different respected universities.

In the survey, series of questions were asked about their opinions and outcome of results in adapting different pedagogical methods which they are using collectively and compared with both the Traditional way of teaching and recent or virtual methods of pedagogy. Just to compare weather this teaching methods are same in the different part of the word, in the initial part of survey questions were asked about their region of teaching and total years of teaching as well as present position that they hold in their respective field.

The main aim of the study is to collect a valued data from highly qualified persons from the respected field only, and all the participants are holds a minimum of an assistant professor post in the field of medical anatomy for to maintain the validity and authenticity of the survey genuinely. All the participants participated in this survey are volunteers with their won will.

Question.1: 'Which country do you work in?

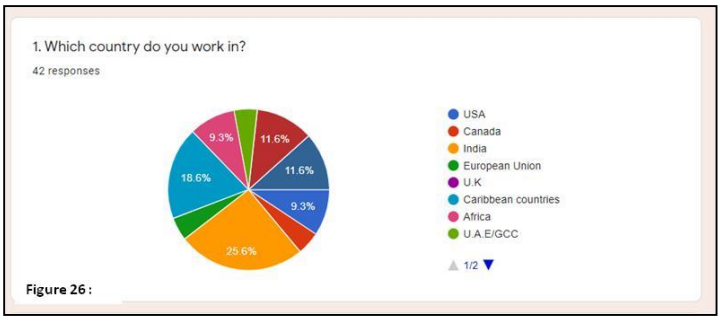

Figure 26 :

Among the **42** participants 11(25.6%) from India, 8(18.6%) from Caribbean countries, 5(11.6%) from Malaysia/Pakistan/Nepal/Nepal, 4(9.3%) from USA, 2(4.7%) from European Union, 2(4.7%) from U.A.E/GCC, 5(11.6%) from other countries which includes Afghanistan and African countries.

Question.2: 'Do you work in a State/(government) or independent Medical School/Medical University?'

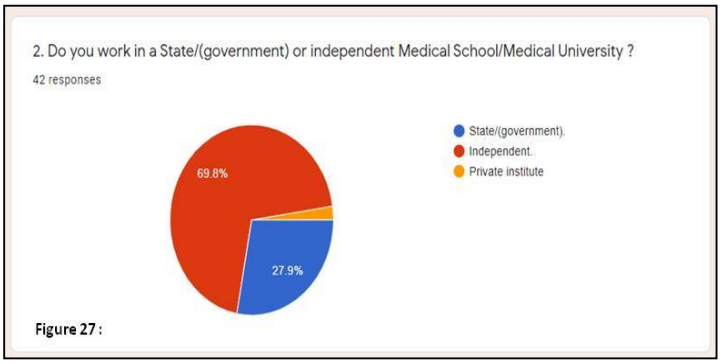

Figure 27 :

Among the **42** participants 30(69.8%) are from Independent universities, 12(27.9%) are from State/ (government) recognised universities, 1(2.3%) from the private university, most of the faculty either working in Independent universities or from the government universities.

Question.3: 'Which kind of Medical school do you usually work in?

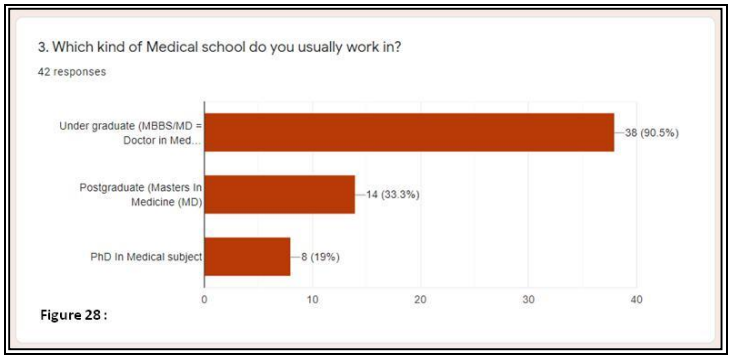

Figure 28 :

Among the **42** participants 38(90.5%) of the faculty engage in teaching 'Under graduate (MBBS/MD = Doctor in Medicine)', 14(13.3%) of the faculty engage in teaching 'Postgraduate (Masters In Medicine (MD)', 8(19%) of the faculty engage in teaching 'PhD In Medical subject'.

Question.4: Which designation at present is best suitable for you?

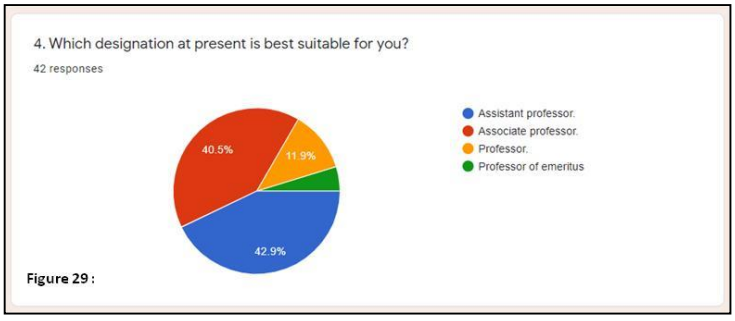

Figure 29 :

Among the **42** participants 5(11.9%) Professor, 17(40.5%) Associate professor, 18(42.9%) Assistant professor, 2(4.8%) are of Professor of emeritus grades.

Question.5: How long have you been teaching anatomy?

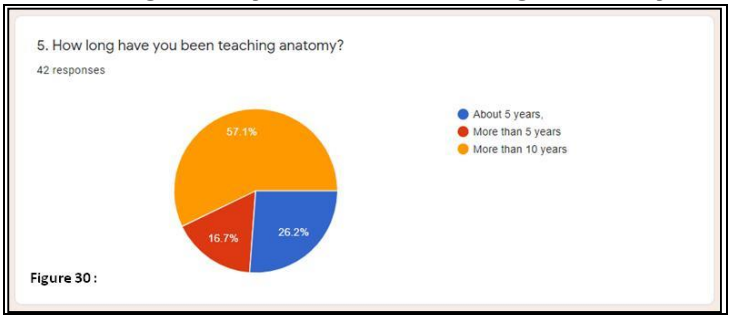

Figure 30 :

Among the **42** participants 24(57.1%) are having More than 10 years of teaching experience, 7(11.6%) are having More than 5 years of teaching experience, 11(26.2%) are having About 5 years of teaching experience in their field.

Question.6A: Which of the following methods do you use in anatomy theory class teaching?

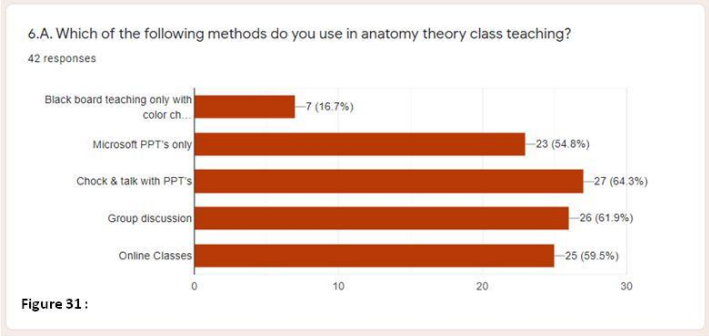

Figure 31 :

Out of **42** participants 'Chock & talk with PPT's' is the major choice of teaching which is about 64.3%, 'Group discussion' is the second choice of teaching which is about 61.9%, and about 59.5% faculty were also involved in 'Online Classes' which is timely demand at present, only 16.7% of the faculty were still dependent on

‘Black board teaching only with color chock’, as for the above study states that most of the theory teaching were conducting all over the word by using Microsoft power point presentation in addition if necessary they will use chock and talk.

Question.6B. **what is your opinion about the selection to your for the above question. How satisfied are you with your student’s feedback for the method you use.**

Most of the faculties were happy and satisfied with using Microsoft power point presentation in their theory teaching. Few of the valued responses from the faculty to the above question are:

Faculty 1: We need to use multi modality to teach. I feel using each modality has its own advantages and disadvantages. Student like chock and Talk with PPT. Online classes don't get the same level of engagement.

Faculty 2: Good student participation for online classes

Faculty 3: Students are satisfied more with PPT presentations and drawing on the board using colored chalk and markers.

Faculty 4: Students enjoy the different pictures the technology provides. It’s much easier and more feasible to utilize picture. Besides that it’s much accurate. Overall students were satisfied with the PowerPoint presentation for anatomy classes

Faculty 5: I think that what most satisfies are the discussion groups, but that considers prior to personal study and also previously in making use of videoconference presentations.

Faculty 6: Some time we need to explain some difficult topic for which we can not stick to only one particular method, we need to incorporate different methods.

Faculty 7: students are having interactive sessions and they are satisfied with it

Question.7.A. which of the following methods do you use in your Practical Anatomy classes teaching?

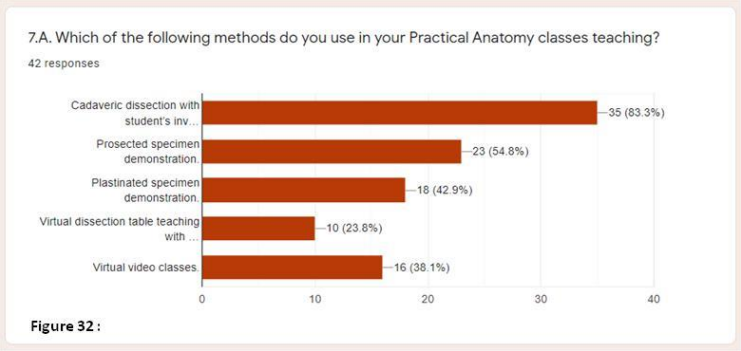

Figure 32 :

Out of **42** participants 35(83.3%) of the faculty agree with the option 'Cadaveric dissection with student's involvement' for practical classes which is the one of the oldest traditional method of teaching anatomy,23(54.8%) of the faculty agree with the option 'Prosected specimen demonstration' mainly those faculty who are teaching for undergraduate students,18(42.9%) of the faculty agree with the option 'Plastinated specimen demonstration' but not for the regular classes, 16(38.1%) are also opt for the 'Virtual video classes' for self learning point of view.

Question.7.B. what is your opinion about the selection to your for the above question. How satisfied are you with your student's feedback for the method you use.

Most of the faculty was happy with cadaveric dissection with active involvement of the students, wherever needs for demonstration faculty were more suggested for additional Plastinated specimens which will be more helpful for teaching.

Few of the valued responses from the faculty to the above question are:

Faculty 1: Cadaveric dissection is the best way to teach anatomy, all other methods are distant second class method. The virtual dissection is also becoming popular.

Faculty 2: It's a great exposure for first year students. Spending the time dissecting would help them retain the structures and enforce concepts.

Faculty 3: When students are involved themselves in dissection then knowledge is retained for longer period.

Faculty 4: In this period in which we have only carried out virtual classes, the most practical has been the joint analysis in demonstration of specimens. I have to clarify that our country (Chile) currently has face-to-face classes suspended; therefore, we are doing classes only in non-face-to-face formats.

Faculty 5: When i was using only cadaver subject was bit difficult for the students as we started using Virtual table it has become very simple.

Faculty 6: Unfortunately in Afghanistan it is not possible to use cadavers. So I try to satisfy them but it is difficult.

Faculty 7: as the virtual table is too expensive to afford.

Faculty 8: Traditional method of cadaveric teaching is more accurate and gives good knowledge

Faculty 9: Students will able to understand only with Hybrid method now.

Faculty 10: Prosected specimens are good for workshops only.

Question.8.A. what is your opinion concerning to Cadaveric dissection method in teaching Human anatomy? (Select if applicable more than one):

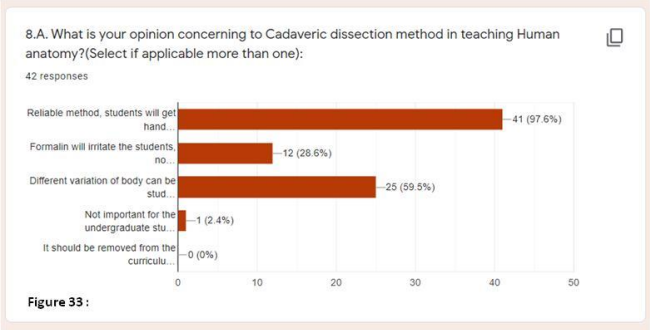

Figure 33 :

Out of **42** participants 41(97.6%) of them opt for the option 'Reliable method, students will get hands-on experience , they Involved in it', 25(59.5%) of them selected additional benefit as 'Different variation of body can be studied', 12(28.6%) participants also empathies that even though it as benefits they listed for the draw back as 'Formalin will irritate the students, not well for health, student doesn't show interest too' .only 1(2.4%) of the participant chosen the option as 'Not important for the undergraduate students. They will spoil lots of cadavers.' Over all suggest that by keeping in mind with health requirement cadaveric dissection is more appropriate for medical anatomy teaching.

9. What is your opinion concerning to Prosected specimen demonstration method in teaching Human Anatomy? (Select if applicable more than one):

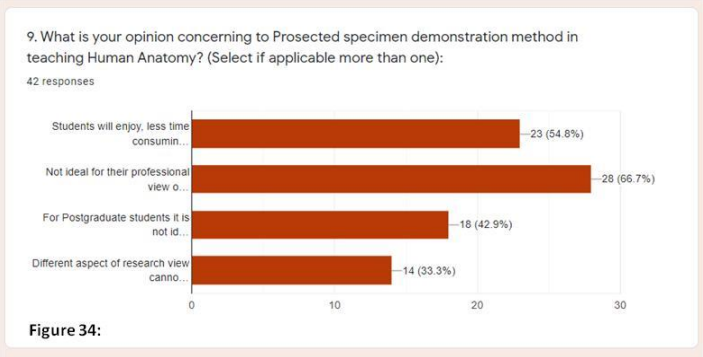

Figure 34:

Out of **42** participants 28(66.7%) opted for the option 'Not ideal for their professional view of point as they don't get hands-on experience', 23(54.8%) opted for the option 'Students will enjoy, less time consuming, less health formalin exposure. Fewer cadavers needed', 18(24.9%) opted for the option 'For Postgraduate students it is not ideal, as they need to be specialized in subject', 14(33.3&) opted for the option 'Different aspect of research view cannot be studied'.

Overall impression suggest that for the postgraduate students **Prosected specimen demonstration method** should not use as standard teaching method, but how ever for the sake of economic and time consuming case it would be better to use for undergraduate students which suggested by 23(54.8%) of the participants, one of the main reason behind this thinking may be due to difficulty in getting cadavers for the medical studies. But still most of the participants believe the traditional cadaveric dissection is more appropriate compare and it should continue to use in teaching anatomy.

10. A. What is your opinion concerning to Plastinated specimen demonstration method in teaching Human Anatomy? (Select if applicable more than one):

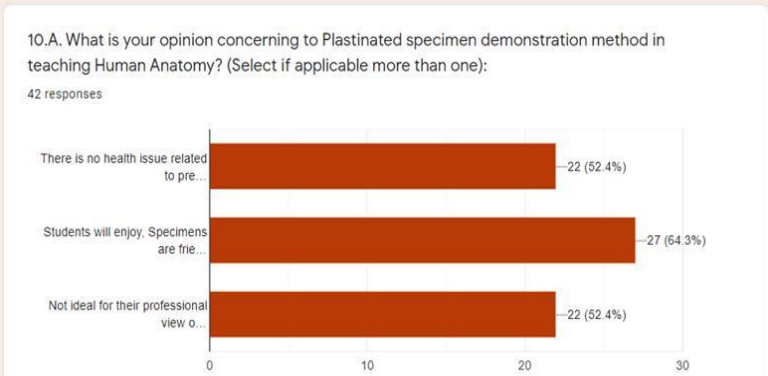

Figure 35:

Out of **42** participants 27(64.3%) opted for the option 'Students will enjoy, Specimens are friendly to handle.' 22(52.4%) opted for the option 'There is no health issue related to preservative exposure', 22(52.4%) opted for the option 'Not ideal for their professional view of point as they don't get hands-on experience'.

Overall impression suggest that students like and more comfortable but as part of teaching most of the participant disagree with use of Plastinated specimen for the sake of regular anatomy classes. This was justified as the students are not able to get 'Hands-On-Experience' by using Plastinated specimens in anatomy curriculum.

11. A. What is your opinion concerning to Virtual dissection table teaching with 3D/4D technology method in teaching Human Anatomy? (Select if applicable more than one):

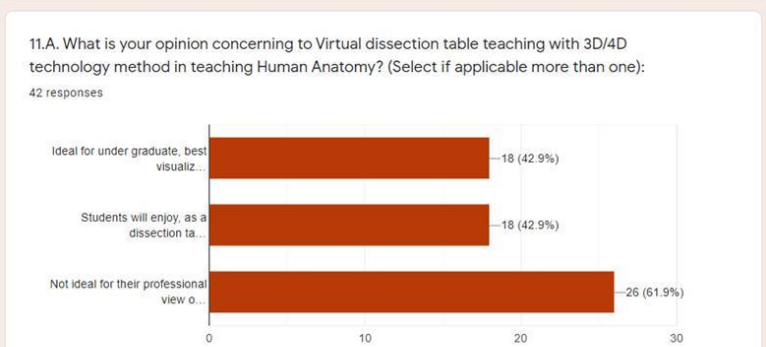

Figure 36:

Related to advanced technology Out of **42** participants 26(61.9%) opted for the option 'Not ideal for their professional view of point as they don't get hands-on experience'; 18(42.9%) opted for the option 'Ideal for under graduate, best visualized all the micro level of structure with different level of body', and 18(42.9%) opted for the option 'Students will enjoy, as a dissection table in monitor based'.

Overall impression suggest that advanced technology are very good for the practitioners, but not for the beginners as they are not able to 'Get hands-on experience', apart from this students will enjoy the study with recent technologies, as it will be more easy and convenient to operate.

11. B. concerning to the above question if any valued suggestion of yours:

Few of the valued responses from the faculty to the above question are:

Faculty 1: convenient but not equivalent to cadaveric dissection. Supplementary learning system.

Faculty 2: In emergency conditions like COVID-19 where online classes are required its good but not for regular classes.

Faculty 3: In case of shortage or absence of teaching materials, teachers or duration for the entire course and for Anatomy then, virtual or Plastination are good choices.

Faculty 4: Very expensive, difficult to maintain. Fancy but not for regular teaching

Faculty 5: As advanced technologies are more important in medical field, main time need to maintain traditional values and methods equally.

Faculty 6: 3D tables though feasible, would reduce the hands on exposure. It is also expensive and carries the risk of technical issues.

Faculty 7: This is a good technique where: - there is a scarcity or non-availability of cadavers or when the number of cadavers don't adequately meet the requirements of the number of students,- More details of the gross structure needs to be shown (especially those details which are lost post-formularization of the cadaver).

Faculty 8: Virtual dissection is a good tool, where it provides faithful view of living organs form a foundational understanding of the body's structures. By using VR headsets or augmented-reality goggles, which show digital imagery superimposed on the real world, students can examine an organ from all angles.

Faculty 9: This method is very good, Very effective during present COVID19 condition. But must accompanied by hands on dissection experience.

Faculty 10: It can use for additional. But cadaveric dissection is important.

12. In Brief based on your knowledge what is best method to teach anatomy?

Finally in the last question faculty were asked to give their personal opinion regarding different methods used in anatomy, among which one is supposed to be the best with their teaching experiences.

Few of the valued responses from the faculty to the above question are:

Faculty 1: Best method would be combination of: 1. Cadaveric dissection. Active learning, 2. Plastinated specimen for demo. And 3. Virtual lab to increase involment and as assessment tool.

Faculty 2: I believes the cadaveric method should take precedence over the other methods. The additional methods may serve as extra options.

Faculty 3: Traditional teaching methods in anatomy by chock &talk with supported PPT presentations only can helps the students to focus on subject. Regarding dissection cadaver is the only tool can helps in practical's I hope.

Faculty 4: Traditional method of teaching anatomy, in my opinion, is the most beneficial one.

Faculty 5: A cadaveric dissection is the best method for hands on experience and research purposes. Others methods will enhance the learning process.

Faculty 6: As advanced technologies are more important in medical field, A composite method of teaching always important. Hybrid method is more reliable at present condition.

Faculty 7: Teaching is an art so it depends on individual how he or she makes it innovative, informative and interesting for students. I will prefer to dissect on cadavers and teach.

Faculty 8: It is very important to have real hand-on experience with real cadaver where students are having hand on experience; interactive sessions and they are satisfied with it.

Faculty 9: Virtual pedagogy cannot substitute face to face learning in large group teaching particularly students coming to medical school from rural background.

Faculty 10: I'd suggest following the traditional dissection lab. It helps students retain more information. It also presents the anatomy course as whole rather than separated entities. Therefore, students will be able to connect segments together to establish a greater picture of the entire body and its connections. However, it's time consuming and it requires more preparations. Traditional dissection also helps students develop their attitude towards the profession of medicine.

PART FOUR

REVIEW OF LITERATURE, SUMMARY,

CONCLUSION, AND RECOMMENDATIONS

REVIEW OF LITERATURE, SUMMARY, CONCLUSION, AND RECOMMENDATIONS

In the previous chapter researcher discussed the results of 'The student centered survey' and the Teachers centered survey. In which both the aspect point of view of student and teachers of anatomy department were briefly analyzed. From this chapter the whole study will be summarized and about this project will conclude with some recommendations. Accordingly, the summary of the work will be presented followed by the conclusion and recommendations.

4.1. Review of literature:

According to 'Jonathan Hugh Sawday: Considering anatomy as a cultural practice, it becomes apparent that the figure of the anatomist was endowed with a peculiar kind of status. The reasons for this are complex. It is possible to say, though, that in the sixteenth and seventeenth century's anatomists figure as models or types of the "new science". They appear to hold a position in the public imagination akin to, say, that held by Darwin in the late nineteenth century and Einstein in the twentieth [(56)].

According to 'Omar A Habbal; Currently, teachers and students of anatomy have the necessary illustrations and information they need to conduct anatomical research. Modern technology ensures that this information is readily available and of the utmost clarity. However, the past eminent scholars who discovered and

developed the various tenants of today's anatomical knowledge should be remembered for the mental, physical and social challenges they faced in the course of their research, which sometimes cost them their lives [57].

According to 'Dzintra Kazoka; The developmental intensity in technologies over the past few years has profoundly affected health care and medical education, and teaching Human Anatomy has been considerably changing during the last decade. The assessment of the discussions of students showed that the majority of them found that the Anatomage Table was an interesting and effective learning tool for developing their knowledge and skills, collaborative learning, using the anatomical language of images of dissections.

A lot of digital images can be instructional tools for teaching Human Anatomy, but we recommend anatomy tutors to mix different teaching methods (new and traditional) in order to create the desired transfer of knowledge. Students need to learn not just anatomical structures and functions but also the relationships between surrounding structures. Our students directly benefited from the digital images during their practical classes. Finally, we suggest that the students and the tutors should use digital images and the animations [58].

According to Notebaert 'First is the idea that traditional classes have a tendency to support or amplify the idea of needing to memorize the content to learn anatomy, even though instructors may indicate that they do not want students to memorize. Delivery of content may need to move away from a focus of identification of specific structures individually and move towards identifying structures in relation to

one another. Instructors could utilize case studies and clinical applications focused on anatomical structures in order to get the students to think more about the body as a whole and not as individual structures and terminology.

While traditional teachers and possibly clinicians may argue that anatomy is about names and terminology, they should understand that our future health professionals need to be able to think about the problems they will face during their careers in relation to the anatomy and not solely worry about identification. Even for students not wishing to pursue a health career, knowledge about how the body's structure is full of relationships may be more useful for these individuals than being able to pick out separate facts and names. It is important that the students learn names or structures and use proper terminology for communication of their ideas, but these things can be done in a student-centered environment without ignoring the importance of learning the language of anatomy.

It is important to note that much of the research in anatomy education, and in general medical education, does little to align with a particular learning theory. Problem-based learning, although not a new instructional method, does attempt to make that bridge in that its development is structured around a learning theory and not just around medical curriculum (Barrows & Tamblyn, 1980). It appears that much of the focus on anatomy and medical education is on the content and how best to deliver it to the students. It should be noted that based on some of the results in this research study, research exploring methods of aligning the practice

of teaching with the desired learning outcomes could be potential fruitful, especially when based on a particular learning theory [59].

According to ‘Lakal O. Dissabandara; The findings of the current study, in agreement with a number of previous studies, support a definitive role of cadaveric dissection in the delivery of an anatomy curriculum in a graduate-entry medical program. While most of the students identify the importance of having cadaveric dissection to learn anatomy, many did not seem to prefer dissection as the sole method of delivery of the anatomy curriculum. Hence, the inclusion of alternative methods such as lectures, prosected materials, models, animations and body painting is recommended. Inclusion of such diverse methods would facilitate the learning experience and cater for the diversity of students who often have different learning styles and expectations based on their prospective careers [60].

According to ‘Bernhard Preim; in the scientific literature, there is no in-depth analysis of resources that are actually used by students, how they integrate the use of these resources with more traditional learning and which exploration features are particularly desired. Most virtual anatomy systems are not carefully integrated in the curriculum; their use is optional and the relevance of using them is not clear. The wide availability of virtual anatomy systems indicates that at least a substantial portion of students employs them.

Several studies indicated that cadaver dissection is still perceived as more important than virtual anatomy -based learning. This is likely due to the haptic interaction. While haptics was used in surgery simulation systems, anatomy

education is based on different learning goals and constraints. Virtual anatomy systems need to be cheaper due to their larger audience. Thus, considerable effort is necessary to adapt haptic feedback to virtual anatomy systems [61].

According to 'Aditi Srivastava & Archana Singh; In medical teaching and learning process active student participation is necessary. It is needed to analyze the implemented curriculum, the mode of teaching, the quality of how it is delivered, and the infrastructure within which it is delivered. With the help of student's feedback we can adopt the better teaching methods like latest tools for teaching along with interactive sessions of teaching between students and faculty, learning process can be improved for anatomy teaching [62].

According to 'Raktim Bandyopadhyay; the teaching of Anatomy plays an important role in the process of training medical professionals and thereby, ensuring safe medical practices. Pedagogy of gross anatomy has always been through cadaver dissections and didactic lectures.

As the learning and teaching has changed a lot over the years, both students and teachers can choose the best suited method to enrich and deliver the knowledge. The students had opined good to average in acquiring skills in different domains of Anatomy. They also welcomed the Early Clinical Exposure in their curriculum. Other newer techniques like horizontal integration and e-learning were also needed for their betterment of studying [63].

According to 'Rashmi Jaiswal; An opinion regarding curriculum, teaching methodology & assessment techniques in anatomy was taken from the first year

MBBS students at People's College of Medical Science and Research Centre, Bhopal. The best method of learning is the chalkboard teaching and dissection hall teaching. Students agreed for multimedia teaching methods as it relies on scientific content and able to understand better. Students favored teacher's notes as a best source of study material, followed by textbooks. This study shows that the planning about the curriculum, teaching methodology & assessment techniques can be modified considering the opinion of the students to bring out the best in them and how teaching can address their contemporary learning needs.

In the end, the two approaches cadavers and computers (used as symbols of practical and theoretical models) are best seen as complementary. We believe that computerization will begin to make enormous contributions to the learning of basic anatomy. Overall at this initial stage of medical profession computer assisted learning system offer flexibility, enabling students to choose the place, time, pace and process of learning, the use of computer rooms can also be useful in learning outside the classroom, such as the review of anatomical subject matter required by students in the later stages of the training in the health care area [64].

Researcher finds that overall works of literature available at present suggest that the traditional teaching anatomy is very important in the point of teaching human anatomy as it gives students to get a chance in active learning and involvement of the subject will be more accurate, as in the feature this student is going to operate with human life it is very important to teach them ethical values which can be only thought by a traditional way of anatomy teaching.

On the other hand, medical education is reliable on advanced technologies which will facilitate students and for the teachers to learn and teach in an adequate time which is more challenging for both teachers and students to simultaneously finish their curriculum at a given time. Most of the literature suggests a “Combination of advanced technology with the traditional way of anatomy teaching’ is need for preset time and condition.

4.2. Summary:

This dissertation has four parts. In the first part which is the introduction; the background of anatomy teaching, Introduction to Pedagogy, The History of Pedagogy, the different teaching styles, some of the most popular teaching theories, a historical timeline of Anatomy, and organization of the dissertation were presented. In the second part material and methods; background of the study; statement of problem and purpose of the study; objectives of the study, significance of the study, the scope of the study, material and methodology of the study; source of the study; data collection procedures and data analysis were presented.

In third part was concentrated on the data discussion. The data were collected from different part of the word from two categories; the first categories of data collected from students those who are presently studying in the anatomy departments of different universities from different part of the word in the form of Google survey; whereas second categories of data collected from highly qualified

professor's opinion of anatomy departments from different universities from different part of the word in the form of Google survey; and data were compared both with the student point of view and teachers point of view in concerning to teaching human anatomy: traditional and virtual pedagogy were discussed. In the second chapter, the theoretical frameworks on which the study is based and review of related literature were discussed.

Finally, the fourth part summarizes, concludes, and recommends some methods of dealing with human anatomy: traditional and virtual pedagogy in references with the review of literature under study.

4.3. Conclusion:

The central aim of this study was to compare teaching human anatomy: traditional and virtual pedagogy. The data for this study was collected from students presently studying and professors who are actively involved in teaching anatomy from different parts of the word. The analysis of the data was based on the feasibility and adapting capability of students was compared with the different methodology which is using in teaching anatomy irrespectively whether a traditional way of teaching or virtual pedagogies, one may conclude that:

- To teach human anatomy it is important that human body as to be involved, for which the cadaveric study of anatomy is essential in all the curriculum, from the present study it is proven that most of the student would like to study by doing cadaveric dissection, irrespective of some health hazards

issues which can be minimized by using advanced logistic instruments such as using exhaust fans, air conditioners in the anatomy laboratory. Cadaveric teaching is one of the oldest methods of teaching.

- As in the recent medical universities, the number of students participates in each class will be more, from this point of view recent methodology of teaching will be having added benefits, second most important traditional way of teaching is chock and talk which can be replaced by ‘Smartboard’ teaching which will maintain the essence of traditional chock and talk method with advanced technology
- As in the recent medical universities, the number of students participates in each class will be more, from this point of view recent methodology of teaching will be having added benefits, second most important traditional way of teaching which was chock and talk which can be replaced by ‘Smartboard’ teaching which will maintain the essence of traditional chock and talk method with advanced technology.
- Most of the professor’s opinion and most of the literature review, and also the present project study finds that in anatomy it is important to incorporate a traditional way of teaching with the aid of advanced technologies.

Finally, it is concluded that in the teaching human anatomy the different virtual pedagogies will help to fasten the teaching process, simultaneously traditional way of teaching will give better understanding of subject to the students for their long

life use in the clinical practice and as a researcher point of view with the background of study it is concluded that “Traditional way of teaching cannot be replaced by other methods” but it is suggested that the present condition and to that of advanced technologies it is better to adapt a **“HYBRID METHOD OF TEACHING”** with the time and present conditional necessity.

4.4. Recommendations:

The main purpose of study is to compare teaching human anatomy: traditional and virtual pedagogy, as in the Part four of the dissertation researcher finds that overall works of literature available at present suggest that the traditional teaching anatomy is very important in the point of teaching human anatomy as it gives students to get a chance in active learning and involvement of the subject will be more accurate, as in the feature this student is going to operate with human life it is very important to teach them ethical values which can be only thought by a traditional way of anatomy teaching.

With the outcome of present study researcher recommends both from the point of view of students centered and teachers centered aspect the combination of traditional way of teaching should be thought in utilization with present technologies, so that the students will be more attracted with the technology and teachers can continues with the moral teaching methods of traditional way of teaching.

- Block board (chalk and talk) teaching method can be replaced with the help of smart board teaching, by doing so the essence of block board teaching will remains continue, this technology can be used for both small group student teaching classes and as well as large group of students teaching classes, with high level of audio and video visualization.
- Microsoft power point can be used in an normal teaching methodology, in which students can get interacted and attracted by different types of anatomical diagrams,
- Dissection can be used and continue in normal regular classes, in addition video of pre-dissected specimens can be utilized beforehand so that students will show more attracted.
- Plastinated specimens, Virtual table dissection remain questionable? As neither the student point of view nor the teachers point of view proven much satisfactory with this study, in regards to this methods further study is required in a large scale date.

With over all outcome of the present study suggests and concluded that "Traditional way of teaching cannot be replaced by other methods", in spite of that it is better to adapt a "HYBRID METHOD OF TEACHING" in Human Anatomy.

No dough that advance technologies are too good and time saving but they lack the student's exposure for 'HANDS ON PRACTICE'.

Quoting famous quote:

'Hands-on experience at the critical time, not systematic knowledge, is what counts in the making of a naturalist. Better to be an untutored savage for a while, not to know the names or anatomical detail. Better to spend long stretches of time just searching and dreaming'.

— Edward O. Wilson (In Naturalist (1994), 11-12.).

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