

## INTEGRATION OF ARTISTIC KNOWLEDGE WITH THE TEACHING OF HUMAN ANATOMY

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**Abstract:** Human Anatomy is the science that studies the macroscopic structures of the human body and has been expressed over the centuries in great artistic works and cultural manifestations. Therefore, the objective of this work was to carry out a brief dissertation on the interactions between artistic and anatomical knowledge.

For this issue, scientific texts capable of promoting the association of both contents were used, which can be represented through images, paintings, drawings, sculptures, various works and various auxiliary methodologies applied to these sciences. It can be concluded that knowing and deepening knowledge about anatomy and its manifestation through artistic and cultural works are capable of stimulating interest in the human body and its interaction with various areas of knowledge, encouraging the active search for information and promoting a integrated learning.

**Keywords:** Anatomy, education, art.

## INTRODUCTION

Exhibitions and artistic manifestations, in general, address a variety of themes, seeking to develop a critical and sensitive outlook, in addition to stimulating a taste for art, exploring the possibilities of expression and interpretation of cultural and intellectual diversity as a way of seeing, living and coexist with art in the spaces of society in general. They consist of a versatile tool for presenting information in a didactic and appropriate way and, regardless of the audience, satisfying them culturally and emotionally, arousing their interest. Additionally, it can contribute to learning or reviewing content in the area of Human Anatomy and integrating it into the classroom, cultural diversity, expressive richness and human difficulties, providing a dynamic look at your reality, your practices and daily options.

The holding of exhibitions and scientific-cultural displays have unique characteristics, normally present in public places, being exhibited in universities, technical schools, public and cultural spaces, professional entities, seeking to form an opinion with the executing team and various academic audiences, business, politicians and the population in general. They can act both in the dissemination of an artistic work and in the study and establishment of scientific knowledge by portraying Human Anatomy represented in works and artistic manifestations.

Therefore, integrating knowledge in Human Anatomy and Arts is important in stimulating interest in the human body and its interaction with different forms of artistic and cultural manifestations. Therefore, the objective of this work was to carry out a brief dissertation on the interactions between artistic and anatomical knowledge. For this, scientific texts capable of promoting the association of both contents were used, reporting the influences of one science in relation to the other.

## DEVELOPMENT

The word Anatomy is derived from the Greek *anatome* (*ana* = through; *tome* = cut) and the word *dissection* derives from Latin (*dis* = separate; *secare* = cut) and is etymologically equivalent to *anatomy* (GARDNER et al., 1982). However, currently, *Anatomy* is a discipline or field of scientific study, while *dissection* is a technique used to study the structure of the body (SOBOTTA, 2013; MOORE, 2014; NETTER, 2015). *Human Anatomy* is the science that studies the structures of the human body, being considered as the foundation for medical sciences (TORTORA, 2010) and for this purpose, the human corpse is used as teaching and study material, which has contributed

and has contributed over the centuries, with teaching and learning about the wonders of the human body. For Dangelo & Fattini (2007), anatomy is the science that studies the human body, naming and describing its constituent structure macro and microscopically.

Historically, the study of Anatomy goes back to Prehistory (VAN DE GRAAFF, 2003). Artistic manifestations and works of art constitute precious sources of information for humanity, in particular, about the ways of seeing and feeling of men and their different ways of being in the world. Since prehistoric times, men who lived in caves and natural shelters used visual language to express themselves through paintings engraved on rocks, containing scenes of fauna and hunting (LENCASTRE & CHAVES, 2003). This prehistoric man was, for a long time, mistakenly considered incapable of producing aesthetic records. In the Paleolithic period, man was an attentive observer of animals and nature itself, characterized mainly by animalistic or zoomorphic representation (LIRA & ALVES, 2015).

This knowledge of anatomy using parietal or rock art was expressed through knowledge of animals. Paleolithic man creates paintings with a very realistic notion of movement. As an example, there is Lascaux, in France; Foz Côa, in Portugal and the Altamira Cave, in Spain. In the record of human anatomy, the Venus of Willendorf expresses the rationality of Paleolithic man and his knowledge about female anatomy, represented through exaggerated forms (LIRA & ALVES, 2015).

In the Neolithic, animalism is replaced by the human figure, becoming part of the representative universe. Through a schematic painting, man's anatomy is represented in a universal and generalizable way. The paintings from the archaeological site of Piauí, in Brazil, characterize this phase (LIRA & ALVES, 2015). Thus, in Ancient History, the corporeal

universe is translated through images and writing, expanding and reinforcing the imagetic discourse (LIRA & ALVES, 2015).

Later, in Mesopotamia, sculptures expressed a rigid body, with few anatomical details. They used the law of frontality, placing heads, legs and feet in profile and the bust frontally. The eye is highlighted, as it is the anatomical reference for dialogue with the world (LIRA & ALVES, 2015). This perception has already changed in relation to Egyptian art. Egyptian art highlights artistic patterns that show reality, how things were and not from a certain point of view. In this sense, people are portrayed in their real form, with the body frontal (with broad shoulders) and a head in profile, showing the legs and feet, unlike other paintings of the human body (LENCASTRE & CHAVES, 2003). Pharaohs and gods were sculpted with a serene appearance and disproportionate bodies in order to demonstrate power and strength. In painting, the law of frontality was also used, with schematic, rigid bodies without representation of movement (LIRA & ALVES, 2015). In tombs, art arises from the imagination regarding the eternity of the soul. The religious concern was related to the destiny after death, as the intact body would guarantee the continuation of life. The Egyptians developed in-depth knowledge of anatomy and physiology. They knew bones, joints, muscles and tendons without violating the body, as they could not damage the bodies by mummifying or embalming them (QUEIROZ, 2005; LIRA & ALVES, 2015).

In Greece, art is anthropocentric, with the human body as its focus. The sculptures represent the idealization of the divine through the human body, transcending corporeal aspects. The Greek sculpture Laocoön is an example of this vision, where the representation of muscular tension occurs in opposition to the calm and serene face

(ECO, 2004). In Rome, art was utilitarian and focused on the interests of the state. Representing power, the faces of authorities were realistically carved into busts. They used mural painting, where bodies were mythologized and deified on the walls of houses, with Pompeii and Herculaneum as examples of this practice (LIRA & ALVES, 2015).

From then on, in the Middle Ages the anatomy of the body was transfigured, becoming subjective and prohibited. Based on suffering, the bodies are pale and disproportionately elongated, often covered up, as in Byzantine paintings. The influence of the church prevents scientific knowledge of the body, which is now studied through the comparison of human anatomy with animal organs (LIRA & ALVES, 2015). As the dissection of human beings was prohibited, the Roman physician and philosopher Claudius Galen, of Greek origin, based his investigations on the detailed examination of monkeys. He was born around 129, in the city of Pergamum, under colonization by the Romans. His studies and theories prevailed in medical concepts in force in the West for more than a millennium, such is the importance and extent of his discoveries. Since the death of the anatomist Galen, anatomy has suffered more than 1000 years of stagnation. However, in 1401, there was a time of ideological changes, which culminated more profoundly in the 14th century, and which we know today as the Renaissance (NAGASHIMA et al., 2009).

The Renaissance was a period marked by intense artistic production and also by the clash between humanist ideals and church dogmas. The artists of this period bring the idea of the valued human being, highlighting the body and exalting beauty (CÔRREA et al., 2008). With this, the Renaissance emerged with an aesthetic concern, with the artistic representation of natural phenomena. In this

conception, it was important for the artist to familiarize himself with the structure and characteristics of these phenomena in an attempt to obtain greater accuracy in his work (SAUNDERS & O'MALLEY, 1950, p. 27).

Modern man established himself in the Renaissance, with the return to Greco-Roman ideals and the recovery of the body as an object of artistic production. The portrait emerges as an expression of identity and science regains its autonomy, with the artist-scientist as its distinguishing feature (LIRA & ALVES, 2015). In the case of anatomy, many 15th century artists possibly watched (and perhaps performed) dissections to create their paintings and sculptures, among other works, and it is prudent to think that they studied much more the anatomy of the surface of the body than the anatomical dissections themselves. said, such as those made in medical schools, and that their interest in the relationship between the forms and uses (in the sense of functions) of the human body is discussed (KICKHÖFEL, 2004).

It is worth highlighting that dissections were prohibited by the clergy since ancient times. Dissections could only be carried out with the authorization of the Pope, who granted it to some professors sponsored by nobles or clerical authorities. Their transgression was generally punished by imprisonment, torture and even death (CÔRREA et al., 2008). However, there came a time when these procedures became necessary, being authorized and controlled by the church (GONZÁLEZ, 1998).

The first dissections were permitted through privileges granted to universities (GONZÁLEZ, 1998). The reasons that allowed the return of the practice of dissections in the late Middle Ages were the need to carry out forensic investigations into the causes of suspicious deaths and the new human values and ideas, which appeared in the Renaissance and fostered a greater interest in the human

body: consciousness of the dignity of man, one of the main themes among Renaissance humanists and the perception that the human body was the standard of all human forms (GONZÁLEZ, 1998; CÔRREA et al., 2008).

In Florence, according to the *Statuta universitatis et studii florentini* of 1387, painters and sculptors were accepted into the *Consorteria dei Medici e degli Speciali* in 1303. According to the document, the artists were given bodies of people who died of natural causes in the hospital of Santa Maria Novella or in other infirmaries in the city, while doctors were provided with only two corpses of hanged criminals of both sexes per year (exceptionally three, two men and one woman) for anatomical exercise. The reason for this unequal distribution was that, while artists only concerned themselves with the surface of the corpses, doctors dissected them and destroyed all their parts (KICKHÖFEL, 2004).

As a result, the cultural Renaissance of the 15th and 16th centuries brought several changes in the fields of arts, culture, politics and religion. Each culture transported its content to the most different areas such as Art, Music and Painting. During this period, in the city of Florence, great artists of the Renaissance emerged and stood out, and in turn, contemporary of Vesálio, Leonardo da Vinci and Michelangelo (FRÓIS, 2005), main representatives of this phase.

Leonardo da Vinci (1452-1519), who brilliantly represented human anatomy, studied the body and its proportions and movements, internal organs, blood flow, reproduction and embryonic development. He drew anatomical structures in a diagrammatic way, representing demonstrations of the functioning of the different parts of the body (CAPRA, 2008). Evidence indicates that Leonardo da Vinci (1452-1519), the multifaceted Renaissance genius, began anatomical investigations

simply to perfect his pictorial representation of the human body. After all, current aesthetics dictated that beauty, in art, was found in the direct representation of natural phenomena (VESALIUS, 1998). In short, there are no documents that support the idea that it was necessary for an artist to familiarize himself with the structure and uses of the human body to represent it in his works, except for the strange and singular case of Leonardo da Vinci, who operated an approximation between the arts and science of the period in an unprecedented and profound way. Leonardo also applied his methods of studying mechanics (his “scientia della machine”) and simple machines to his studies of anatomy. Leonardo da Vinci’s own willingness to draw served as the basis for his way of elaborating and formalizing his ideas (KICKHÖFEL, 2004).

When painting a man leaning over, in “Adoration”, Leonardo was concerned with the detail of each muscle so that he could accurately portray what he saw. To do this, he had to understand the human body and he only achieved this through his studies on anatomy, during which he dissected 33 bodies and made several drawings of the sections of the pieces, which are still used today (NASCIMENTO et al., 2003). In all the studies carried out by Leonardo da Vinci, his commitment to science clearly appears, through calculations, measurements and logical reasoning, but filled with art, sensitivity and intuition. Leonardo believed that there are rules in painting just as there are in mathematical laws (NASCIMENTO et al., 2003). When studying human anatomy, Leonardo da Vinci assigned measurements that he considered ideal for a man, such as the proportions between the head and the height of the body and its parts (limbs and trunk). Still in the same study, he determined the limits of limb movements so that their functions could be used without

harm to the joints (NASCIMENTO et al., 2003).

Andreas Vesalius (1514 -1564) was considered the “Father of Anatomy” and created the first anatomical treatise, combining text and beautiful illustrations of the human body (BARRETO & OLIVEIRA, 2006; LIRA & ALVES, 2015). As a result, artists began to work for anatomists at universities, a fact evidenced mainly by the work of Andreas Vesalius, *De humanis corporis fabrica*, made on Italian soil and published in Basel in 1543 (KICKHÖFEL, 2004). *De Humanis Corporis Fabrica* was the first work of anatomy in which the illustration rivaled the text in care, importance and grandeur. Observing the wealth of details that make up his engravings, it is difficult to imagine that the plates from which they originate were carved from wood (box). It was up to Andreas Vesalius (1514-1564), from Brussels, physician, surgeon and anatomist, to contextualize his works within the Renaissance medical tradition and anatomical illustration. It is truly a masterpiece, originally published in 1543, in which the author left his contributions to the study and teaching of anatomy. At that time, the first half of the 19th century, the subject was taught mainly through reading texts. And most of the available anatomical texts were derived from traditional Arabic writings of the medieval period (VESALIUS, 1998).

Also notable during this period was Michelangelo Buonarroti, an Italian doctor, born on March 6, 1475, and at the age of 18 he was already a trained artist and fully knowledgeable about anatomy, which he portrayed in his works (CÔRREA, 2007; NAGASHIMA et al., 2009). He demonstrated his interest in Anatomy through dissection sessions. He began to clandestinely dissect corpses of executed criminals, indigents and those from hospitals, providing a deep knowledge of Human Anatomy (CÔRREA et

al., 2008).

Thus, Michelangelo was considered an exponent as an artist-scientist, and left a true anatomy lesson in the Sistine Chapel, with bones, nerves, muscles, viscera, arteries and human organs camouflaged amidst biblical scenes, being considered his greatest legacy to the world. humanity, which codified Anatomy in art (BARRETO & OLIVEIRA, 2006; NAGASHIMA et al., 2009; LIRA & ALVES, 2015). During his lifetime, he produced magnificent works that demonstrate his profound knowledge of anatomical structures. He became universally known for his magnificent frescoes and sculptures, he was an architect, sculptor, painter and poet (CÔRREA et al., 2008).

Among his works, the sculpture of three statues for the tomb of Saint Dominic, in Bologna, stands out. Returning to Florence, Michelangelo sculpted “Crucifixion”, which he donated to the church, in gratitude for allowing the cadavers preserved there to be studied (LOPERA, 2004; NAGASHIMA et al., 2009). He moved to Rome, where he sculpted “Bacchus.” However, his greatest work from this period was “Pieta”, both in marble, which can be found in Saint Peter’s Basilica, in Rome. Returning to Florence he sculpted “David”, and after three years, he painted “The Holy Family”, better known as Tondo Doni. Michelangelo received an invitation from Pope Julius II to create the papal tomb, a work he never finished, as he was constantly interrupted by other calls (CIVITA, 1973). From 1536 to 1541 he painted the frescoes of the “Last Judgment” in the Cistine Chapel (NAGASHIMA et al., 2009). He painted camouflaged anatomical structures on many figures in the Sistine Chapel, in order to provide a somewhat original anatomy lesson, as he had extensive experience in dissection, carried out systematic anatomy studies, in addition to his great interest in the anatomy of

internal organs (KICKHÖFEL, 2004).

After the Renaissance, the Baroque period was marked by being highly religious. The body starts to be represented in a contorted and dramatic way, with theatricalization in the works. Caravaggio represents the painting that seeks the union between the profane and the sacred in a common body. Rembrandt was excellent in the use of light and dark, being a great knowledge of anatomy, using this theme in his paintings. As an example, the painting “Dr. Tulp’s anatomy class” stands out, about the dissection of a corpse (LIRA & ALVES, 2015).

In contemporary times, in the Neoclassical period, there is a return to the idealized body, portrayed based on Greco-Roman inspiration. The body is represented with the paleness of the skin linked to the texture of classical sculptures, with a realistic image (LIRA & ALVES, 2015). Modernism is the break with the paradigms of previous schools. Until then, recording reality was the direct function of the painter, with his knowledge of anatomy. Now it is photography and cinema that capture this reality. Science is with the Impressionists, as the focus becomes the study of light and its effects on painting, highlighting Claude Monet, Edgard Degas, Édouard Manet, Paul Cézanne (LIRA & ALVES, 2015). By not needing to stick to the body as a reality, the body starts to be represented as a subjection. With this, movements such as impressionism, cubism, surrealism, dadaism, expressionism, among others, emerged (LIRA & ALVES, 2015).

In Postmodernism, a new look at human anatomy redefines the notion of body. The computer creates artistic images, combining science, technology and art. The body becomes a product, with established standards of beauty and aesthetics of a media nature. Photoshop creates “perfect” bodies and globalizes idealized aesthetic standards,

aiming to consume a non-existent and unattainable body. Taxidermy turns into plastination and, despite suffering criticism and ethical questions, Gunther von Hagens seeks to articulate human anatomy and art (LIRA & ALVES, 2015).

This articulation was widely noted in the restoration of the Chemin d’oubli work where traces of the old anatomy prints can be seen. In the 1960s, anatomy participated with modeling and perspective, “in the related sciences and drawing techniques”. Although linked to nude drawing, anatomy as a science holds, in the eyes of the student, true knowledge. Osteology and the delicate precision of its joints combined with myology, traced fiber by fiber, is an enchantment (CHIRON, 2004).

In addition to great artistic works, another manifestation that also addresses Anatomy content is observed in the Performing Arts, which can be used as a methodology to explore the human body (SILVA et al., 2012).

Therefore, by using the body as an instrument and theater to construct the bodily segments, adding cognitive efforts of ordering, memory and creativity, it is possible to address theoretical and practical content in the characters’ speeches and gestures, in particular, the respiratory systems, circulatory, nervous and muscular (SILVA et al., 2001).

Silva, et al. (2001) state that an effective and creative methodology using performing arts and theater for scientific education becomes a way to facilitate understanding and fixing themes related to human anatomy. In this context, students, in addition to studying and attending classes more frequently to perform theater, become more attentive to subjects, increasing learning through retention, as this major problem of lack of attention is reduced, in addition to subsequently transmit the content in a playful and interactive way. This way of learning Human Anatomy is

very valid, according to Derdyk (1990) and Gorodicht (2001), when they state that artistic representation leads the student to understand the body figure in another way and to forward these representative data to their reality, as well as for your memory file, making learning favorable.

This interaction between art and its manifestations with Anatomy is essential in stimulating the teaching of science through art history, using anatomical knowledge based on artistic manifestations, with the human body as a theme (LIRA & ALVES, 2015). This science-body relationship has been observed since the Renaissance, where the human body has been unveiled. First it was the skin, then other layers, reaching the muscles and tendons. Finally, the skull, mechanical reproductions of breathing, digestion, body movements, and even blood circulation mechanisms (NOVAES, 2003, p.8).

The use of images in the representation and transmission of knowledge, especially observed in the Arts, is capable of awakening and attracting the public's attention, in addition to contributing to the improvement of perceptual capacity and assisting in the formation of correct and objective concepts. Thus, it can favor understanding and improve the integration of learning, generate attitudes of active participation and encourage cooperation between those involved, contributing to the development of reflection and critical spirit (FERNANDEZ MUÑOZ, 1997). It can be considered that the use of creativity through the arts makes learning lasting. The development of learning achieves spectacular triumphs in art and thought, as it makes it possible to organize the content taught, improve student performance by making plays and puppets and consolidate the teaching of anatomy. Thus, the student becomes a participatory agent and the teacher an organizing agent of learning, improving

educational practices (SILVA et al., 2001).

Proposals for didactic strategies for teaching Anatomy must be varied, meaningful and capable of promoting the appropriation of knowledge by students. Teaching, directing and guiding learning is the task of the teacher, who plays a fundamental role as an articulator and mediator between the knowledge elaborated and that produced. Therefore, the discipline of Anatomy is considered fundamental in the training of various professions in the health sector, but it can also be extended to courses that use its fundamentals to deliver specific content, such as the design of furniture and ergonomic equipment. In this aspect, it constitutes an instrument for preventing health problems for professionals such as musicians, dancers, workers from different occupational areas who lack basic instruction in Anatomy, including for students in the biological area of elementary and secondary basic education (SOMERA et al, 2009).

Commonly, Anatomy teaching is carried out through theoretical and practical classes using established methods of observing anatomical parts, techniques for dissecting parts from whole formalized cadavers or their parts prepared and stored in special vats in 10% formalin solution. (SOMERA et al., 2009). Furthermore, didactic strategies can be included to enrich Anatomy teaching, such as: Museum, Anatomy Fair, Demonstration Teaching Laboratory, Independent Studies or Self-Directed Learning, among others (SOMERA et al., 2009). Such activities aim to allow the interested party to get to know the structures of the body, obtain three-dimensional knowledge of the organs, understand their most relevant aspects, understand the connections between different organs and their mutual relationships, in addition to the notions arising from the interdisciplinary relationships made by the



subjects, providing significant cognitive bridges between pre-existing knowledge and that which will be assimilated. For these objectives to be achieved, familiarity with the organs and systems is a prerequisite and this is obtained through observation, handling, direct visualization and teaching explanations (SOMERA et al., 2009).

Active teaching brings together meaningful teaching strategies for students, favors group interaction and teamwork and overcomes the passive learning process, characteristic of traditional teaching methods. Thus, it facilitates the self-directed acquisition of knowledge, enabling the student to learn to select, in a critical and judicious manner, the appropriate forms for their academic experience of the principle of learning to learn (SOMERA et al., 2009). In this sense, the interaction between Anatomy and Art seeks to stimulate the teaching of science through artistic manifestations through theoretical-practical activities with strategies based on art history, body language and science. Therefore, it aims to awaken interest in teaching science through art, using art history as an alternative for teaching (LIRA & ALVES, 2015).

In the teaching of human anatomy, dialectically science and art can constitute a “body” of knowledge. Using art history in a multidimensional way, the study of the body recovers its original meaning, that is, it becomes a discovery, a challenge in search of unveiling the trajectory of humanity’s hypotheses and discoveries regarding man and his anatomical constitution (LIRA & ALVES, 2015). In the classroom, the teacher must instigate questions, problematize the understanding of the body in different historical periods and aesthetics as an expression of anatomical knowledge at all times. The use of images and representations of body knowledge in the past will promote a reinterpretation of the trajectory of anatomical

conceptions and concepts through scientific and aesthetic knowledge of the present (LIRA & ALVES, 2015).

However, difficulties are reported in learning Anatomy, which may be intertwined with the student’s lack of familiarity with anatomical terminologies, which are mostly derived from Latin and Greek; due to inadequate preparation and difficulty in renewing the cadaveric parts, which ends up making visualization difficult, in addition to the fact that many structures are small in size; as well as lack of attention and motivation on the part of students (SILVA & BRITO, 2013). According to Fornaziero et al. (2010), there is a need to expand options in education, introducing innovative methodologies for the teaching-learning process, providing alternatives to integrate and streamline Human Anatomy classes.

This way, it is possible to work on teaching Anatomy through the history of art as a facilitating agent for learning, seeking a correlation between art and anatomy, focusing on knowledge of organic systems as a basis for studying and understanding the human body. This method is extremely important for the training of health professionals, as it seeks a better understanding of the structure and function of the human body and works with instruments that facilitate teaching-learning, with a consequent understanding of our body structure and, indirectly, from knowledge of human physiology.

In order to contribute to the understanding of the art-science binomial, contextualizing the concept of body in the different phases of art history and relating the scientific and artistic-cultural universes, the creation of innovative proposals and teaching tools must be encouraged. Learning that combines biological knowledge with the history of art and science through time (LIRA & ALVES, 2015). Both Biology and art used the body

as an object of study, seeking to understand the mysteries of human anatomy through science and revealing them through art (LIRA & ALVES, 2015). Art arises, in this sense, to express the anatomical knowledge of a body that lives and that is constituted through the manifestation of its knowledge about itself, considering historical, philosophical, ethical and aesthetic aspects (LIRA & ALVES, 2015). Great geniuses of our civilization artistically represented knowledge that cannot always be translated literally through rational and

technical texts (LIRA & ALVES, 2015).

## CONCLUSION

Given the text discussed, it can be concluded that knowing and deepening knowledge about anatomy and its manifestation through artistic and cultural works are capable of stimulating interest in the human body and its interaction with the various areas of knowledge, encouraging active search information and promoting integrated learning.

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