

We are IntechOpen, the world's leading publisher of Open Access books Built by scientists, for scientists

6,900

Open access books available

186,000

International authors and editors

200M

Downloads

Our authors are among the

154

Countries delivered to

TOP 1%

most cited scientists

12.2%

Contributors from top 500 universities



WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com



Learning through Art in Medical Education

Vincenza Ferrara

Abstract

Medical Humanities approach is becoming an important action in the health curriculum. Art can play a central role in the training of care staff for the development of skills and for the humanization of the therapeutic path. The application of art as a tool for learning and its historical relationship with medicine can be a valid support for the development of skills such as observation, active listening, problem solving and empathy, useful for improving the profession and the relationship with the patient. It is possible to rediscover the link between art, medicine, and care to help health professionals to improve their activities and resilience. Particular methods such as that of the Visual Thinking Strategies (VTS) can help health students and professionals to become better actors in the care context.

Keywords: medical humanities, skills, visual art, resilience, health curriculum

1. Introduction

This contribution introduces the Medical Humanities approach to the health sector. Medical Humanities constitute an approach to care using the “human sciences” as a tool to improve skills and abilities and to limit the stress of care professionals and operators.

A useful discipline in this context is related to cultural heritage, as all artistic objects can be “places” of observation and “mirror” of one’s knowledge and skills, becoming tools for learning and well-being. In particular, we will refer to experiences in the medical education sector that uses visual art.

Going deeper into the topic, we can realize, for example, how art and medicine have been integrated for centuries. It is enough to go far back in time to find examples transmitted by artistic objects to understand, as a whole, the importance of the solid relationship between medicine and the visual arts.

Art can therefore lead us, through its observation, to understand the anatomy represented or the reality of the cure, in fact, over the centuries, it has become a witness to illness, death, and healing activities. In the care sector, there are many references to art as therapy and many studies that show psycho-physiological evidence of the positive effects that artistic practice and its use can have on the person for the promotion of well-being and health.

For some years, the humanities and in particular, arts have also been used for the development of skills in learning environments. One of these sectors is that of basic and permanent training in the area of care (medicine, health professions) and more generally in the area of health in which Human Sciences have been introduced

for the application of innovative models for the development of useful skills. This approach is referred to as Medical Humanities.

We will therefore try to describe the opportunity that the visual arts and pedagogical methodologies can offer to the field of medical education for the development of skills and abilities to improve the work of health professionals, increase resilience, and promote their well-being.

2. Art and medicine

As a result of reading history, we can be aware of how much art and medicine have remained integrated for centuries. It is enough to go far back in time to find examples transmitted by artistic objects to understand, as a whole, the importance of the solid relationship between medicine and visual arts starting from when in ancient Greece, which can be considered the cradle of our modern culture, the anatomists asked the artists for help to understand the human body. In fact, at that time, dissection was practiced on the bodies of animals, while it was forbidden to explore human anatomy for social and religious reasons.

Respect for the body of the deceased on the one hand and the consideration of the corpse as a source of impurity on the other had meant that the conditions were not created for carrying out this type of investigation. Even after 1241, the year of the edict of Frederick II which authorized, and indeed stimulated, the use of dissection of corpses, the anatomical investigation was accompanied throughout its path by the activity of artists who have put their skills at the service of scientific studies and of the representation of the human body, which needed scientific investigation to be able to fully express itself.

The practice of observation and the in-depth study of shapes allowed them to reproduce the muscles in a way that exactly correspond to anatomical science and often in the sculptures we can look at muscle groups portrayed in the act of participating in the movement of the body as a whole.

Art can therefore lead us, through its observation, to understand the anatomy represented or the reality of the cure; in fact, over the centuries, it has become a witness to illness, death, and healing activities. Through art it is possible to have evidence of missing pathologies and diseases useful for study, as the Italian doctor, G. Franceschini already wrote about it in 1906, who suggested that “Even the saddest and most painful sides of human life... have been... subject of study by artists, and how even the most pitiful and repulsive sciences of medicine have snatched from the creative brush of the passionate craftsman, pulsating works of life, truth, sentiment. And since beauty is the splendor of truth, it can be said that even the crudest truths of human pathology, clothed in the splendors of art from a skillful hand of craftsman, contributed to the creation of beauty, with sublime works of painting and sculpture” [1].

Art is also a representation of reality and can present itself as a “mirror” for the viewer who can understand emotions and knowledge of activities and meanings related to their personal experiences. Art, as experience, has often guided the pedagogical studies to be used as a tool to develop innovative educational methods [2].

The cognitive reaction to the processes of creation and use of the artistic image can determine knowledge. Starting from this concept, we can understand, first of all, why the observation of art can stimulate us to consider more than one interpretation and therefore more than one possible solution to a single question. Important in this area is the research of R. Arnheim. It explains the connection between visual perception and thought. “Identifying what we see is an act of knowledge,” Arnheim tells us according to the psychology of perception [3]. When we look at

something, mechanisms of understanding are rapidly implemented to recognize and grasp the sense of what is placed before our eyes. Furthermore, thanks to visual stimuli, thoughts and skills to solve problems are automatically set in motion. The careful observation of a work of art activates, in an almost instinctive way, multiple reasoning capable to achieve logical and analytical solutions, thanks to the multiple intelligences useful for cognitive development, including, mostly, the visual-spatial one [4].

In the care sector, there are many references to art as therapy and many studies that show psycho-physiological evidence of the positive effects that artistic practice and its use can have on the person for the promotion of well-being and health.

The role of visual arts and their usefulness, both for therapy and for the promotion of well-being and for the development of clinical skills, is highlighted by the report of the European section of the World Health Organization [5]. Furthermore, exposure to arts or exercising artistic activities can be “therapeutic,” lowering cortisol levels and therefore limiting stress [6, 7].

3. Learning through art

For some years, the humanities, specially the arts, have also been used for the development of skills in learning environments. One of these sectors is that of basic and continuing medical education in the area of care (medicine, health professions) and more generally of the health sector in which for several years the Human Sciences have been introduced. These disciplines have been applied in innovative learning models for the development of skills useful to the care profession for building a Medical Humanities approach. Recent studies have shown how activities related to the arts can help; for example, medical students have benefitted from such activities to develop a certain type of skills and, moreover, to limit the risk of stress and burnout during the years of clinical practice [8].

It should be noted that already in 1948, the Constitution of the World Health Organization gave an alternative definition of health to that considered by the biomedical model: “A state of complete physical, social and mental well-being, and not only the ‘absence of disease or infirmity...’ [9], and subsequently describing health promotion in the Ottawa charter: “Health is considered not so much an abstract condition as a means aimed at an objective which, in operational terms, can be considered a resource that allows people to lead a productive life on an individual, social and economic level. Health is a resource for daily life and not the purpose of existence. It is a positive concept that enhances social and personal resources, as well as physical abilities” [10].

This holistic vision of health led to the research and definition of a new bio-psycho-social approach applied to the medical and health area with the assumption that every health condition or disease is the consequence of the interaction between biological, psychological, and social. In addition, the basic methodological triad for the clinical trial is defined consisting of observation (external vision), introspection (internal vision), and dialog (interview) and these ultimately render the patient’s data as scientific [11].

We can therefore talk to extend the concept of health about “global well-being.”

This approach places the patient at the center of the treatment process and solicits the doctor or health professional to review his preparation in order to face the knowledge of the disease in a holistic context trying to improve “The medical gaze”, the so-called clinical eye considered the “semiological ability to use the senses to produce the diagnosis of a disease.” The skills and abilities useful in this context are therefore linked to soft skills, teamwork, understanding the other through

empathy and self-care of the health worker to limit the stress that this type of activity can feed. Among the activities useful for the development of skills we also find pedagogical methods that use the arts and in particular the visual arts. Regarding the adoption of these methods in medical and health education, a lot of scientific literature can be found indicating growing evidence that traits associated with empathy, for example, can be cultivated and taught through guided observation of works of visual art [12]. In addition, visual arts help in the development of clinical skills, including the observation, analysis, and communication of visual information. Representational art allows students to focus on identifying recognizable shapes and contextual information, while abstract art encourages the development of pattern recognition skills and greater tolerance of ambiguity with the freedom to follow one's imagination and emotion. Also in Italy, the introduction of pedagogical methods that use visual art as a tool for improving certain skills and abilities in the field of Medical Education is being experimented with positive results [13].

An important element in this context is training for all those who work to improve the relations between professional care and patients. Important skills are those related to collaborative work, communication, and empathy. Being empathetic, patient-centered, compassionate, humble, and respectful is essential for healthcare professionals to deliver holistic care. Another important activity to practice is to facilitate useful strategies for limiting stress and burnout in operators with a decrease in empathy and observation and analysis skills starting from basic training to continuing education. Furthermore, an important skill is that related to critical thinking to keep an open mind, self-awareness and respect and appreciation of different points of view that make each situation and patient experience unique [14].

4. Art practice and medical education

The art works represent the moods, the relational dynamics, and the emotions that can be learned and recognized through exercise. Some collaborative activities related to the observation of a work of art can also help to change the approach with the other and therefore with the patient and his family.

One of the methods that use artistic images and which has been applied for years in the United States and experimented in Italy for basic and continuing training in the medical and health area is Visual Thinking Strategies (VTS). VTS originated in 1988 from the integration of the research of the cognitive psychologist Abigail Housen and Philip Yenawine educator at the Museum of Modern Art in New York [15, 16].

This structured method for involving museum visitors becomes an important tool for learning in school and an important activity in the medical and health education sector [17]. The practice of VTS takes place in small groups, in front of a work of art, considered equal for basic knowledge and culture. An experienced facilitator will use only three questions to lead the discussion. It is important to listen to the opinions of others, as everyone will be able to enrich their point of view, creating a collective consciousness.

The questions are as follows: What is going on in this picture? What do you see that makes you say that? What else can you find?

It is therefore important that the observations and opinions of the participants are always substantiated by visual elements. This apparently simple step activates cognitive mechanisms for recognizing reality on the basis of one's previous experiences.

The experience of observing the image with the VTS method stimulates the awareness of how perception works: at the beginning, we have an overview, we

identify details that, based on our knowledge and experience, lead us to an elaboration of the information perceived by assigning a certain meaning, the subsequent observation and listening to other possible interpretations, based on new details or the same decoded in a different way, lead us to a further elaboration and assignment of meaning, thus activating a problem-solving process. This experience also suggests that we need to take time in front of an image to understand its meaning. This exercise makes us reflect on the multiple interpretations that the same image can suggest; in fact, if we are based on previous knowledge and experiences, the same image can be understood and therefore described differently by each participant, thus learning to accept the ambiguity of the perception related to our knowledge and that of others. This exercise helps us to develop divergent thinking at the basis of creativity. Group discussion also allows to improve communication and listening skills.

In summary, we can list a series of objectives and purposes that have emerged in the various studies conducted on VTS related to the medical and health profession:

- a. Improve observation and clinical reasoning skills, or better understand the clinical scenario (patient and social context).
- b. Improve communication skills, fundamental skills in the work of the doctor and nurse and more generally of the health professional, both in the relationship with the patient and family members, and with colleagues.
- c. Encourage critical thinking and problem solving, which in clinical practice translate into a guide to choose the best solution for the patient.
- d. Promote empathy, which is fundamental in the relationship of care with the patient.
- e. Express oneself freely; this is especially important for students, as it improves the quality of learning.
- f. Improve the tolerance of ambiguity, that is, get used to the diversity of the individual and the individuality of responses to treatment.
- g. Improve interpersonal skills and therefore group work.

An interesting analogy that we can focus on is that between the modality of discussion in small groups that the VTS stimulates in front of a work of art and the visits or meetings organized with the care team during which doctors present, discuss, and plan for patient health with students' request for hypothesis with experts acting as mentors and facilitators to guide discussion and formulate a care plan [18].

These activities with art can be very useful for improving the skills such as observation, problem solving, and critical thinking. In this context, the clinical observation, which includes the identification of data, the recognition of patterns in the collected data, and the interpretation and re-reading of the same, is the basis of the complex decision-making process of the doctor, through which he collects data, achieves the conclusions and chooses the most suitable therapy.

The skills of problem solving and critical thinking are also considered key and fundamental skills in the care sector, and art can help in their development. This arrangement is linked to the essence of the artistic artifact: the work of art can be defined as a "text" open to multiple levels of reading and the information it offers can be correlated with each other even if with a different meaning, as they can be

represented as conceptual nodes of a hypertext that is configured while the perception continues to be applied with the identification of new details and therefore with the elaboration of new contents starting from the attributed meanings. In relation to the development of Critical Thinking, we find an interesting example that represents a useful collaboration between the cultural sector and medicine. Ohio State University College of Medicine (OSUCOM), in partnership with the Columbus Museum of Art (CMA), during the 2010–2011 academic year conducted an innovative experience for medical students who applied the analysis of works of art using observation supported by a column on critical thinking combined with a group discussion called “Art of Analysis.” The critical thinking column is called “ODIP”, an acronym for “observe, describe, interpret, and demonstrate.” The goals of the Art of Analysis (AoA) are to encourage critical thinking skills, generate empathy, create a foundation for cooperative outcomes, increase students’ tolerance for ambiguity, and improve the observation skills of junior doctors. This activity includes a form that suggests activating an observation, a description, an interpretation and a test, stimulating the students to learn to collect information objectively, to identify different possible interpretations to choose the best one based on evidence and therefore to implement a problem solving and critical thinking process [19]. Another fundamental skill for doctors and care staff is empathy. The term empathy derives from the Greek word “εμπάθεια” (> en and patheo, that is “inside” and “feel” = “feel inside”, “put yourself in the other’s shoes”); it indicated the emotional relationship of participation that bound the author-cantor to his audience. The term “empathy” has been equated with the German “Einfühlung”, coined by the philosopher Robert Vischer at the end of the nineteenth century and only later it was translated into the English term “empathy.” Vischer also defined for the first time the specific meaning of esthetic sympathy, or the feeling, not otherwise definable, that one feels in front of a work of art.

Vischer conceived this term as the ability to feel inside and to allow, that is, to perceive the external nature, as internal, belonging to our own body. It therefore represents the ability to project feelings from us to others and to the things we perceive [20].

In the human sciences, empathy designates an attitude toward others characterized by a commitment to understanding the other, excluding any personal affective attitude (sympathy, antipathy) and any moral judgment. Fundamental in this context was the discovery of mirror neurons by the research group of Prof. G. Rizzolatti. It is a particular class of cells that are activated both when a person performs an action and when he sees him doing, thus allowing us to understand what others are doing or feeling. It is therefore a fundamental mechanism not only for learning through imitation, but also to make the observer participates in the emotions of others or rather recognize the state of the other [21]. It is now clear that we cannot ignore taking care of the whole person to treat his illness and therefore empathy is considered essential for a good doctor-patient relationship. Also, for this type of ability, the work of art can be a valid tool for understanding the complexity of human nature. In particular, courses based on the observation of art have been shown to help students be more aware of emotions, their role in medicine, and to express empathy.

An interesting example concerns the program of the course for medical students of the Weill Cornell Medical College in collaboration with the Frick Collection art museum of New York published in 2001. The program included the examination of the portraits of the museum by students with the help of experts of art and by doctors according to indications that they had to replicate with photographs of the faces of patients. This activity is useful not only to improve observation skills but also to learn to understand the different states mood and the different emotions of the faces developing a greater emotional awareness [22].

A capacity whose concept was defined not so long ago is the Tolerance of Ambiguity.

Intolerance to ambiguity, or aversion to ambiguity, was first identified more than 50 years ago. It has been described as a personality trait in which “new, complex or insoluble” situations are perceived as “sources of threat.” Given that the field of medicine and healthcare can be characterized by novelty, complexity, and sometimes insolubility, it is extremely important to understand how clinicians, and others, react to such circumstances. In general, individuals with high tolerance for ambiguity are attracted or fascinated by the unknown. Conversely, those with low tolerance tend to deny, avoid, or minimize ambiguity and experience significant stress on account of it. In medical practice, low tolerance of ambiguity is associated with the biomedical model rather than a bio-psycho-social vision of care [23].

The increase in the intolerance of ambiguity can be associated with stress [24]. Yet studies indicate that medical students or healthcare staff may feel uncomfortable with ambiguity. The use of Medical Humanities and in particular art can help improve this ability.

Another important practice that uses art is icono-diagnosis, which can help in learning a correct diagnosis process. The concept of icono-diagnosis was introduced in 1983 by A. Pontius, a psychiatrist at Harvard University, committed to demonstrate the ancient presence of Crouzon syndrome in the Cook archipelago, examining the features of the statues found in these islands [25]. In recent years, several doctors such as V. Franco, pathologist of the University of Palermo [26] or F.J. Barbado bring their students to the Prado Museum for a “medical examination” to the artworks exposed [27]. The enormous talent of the great masters of painting allows only by looking at a portrait to imagine the thoughts of this person and his state of mind. With our didactic activity, however, we can go further, and by observing carefully, know more intimate details such as; a disease that may have plagued the person, their past history and their wishes. For example, always with careful observation, a spot on the skin, a knot in the neck or a strange formation in the fingers can show signs of specific pathologies. These can be traced back to the models that have been immortalized and confirm our theories with other historical sources. Thus, through this practice, it is possible to “train” the clinical eye. It allows also to rewrite the history of the people portrayed or of the artists. An Italian study published in the *Journal of the Royal Society of Medicine* analyzed three portraits of Michelangelo, arguing that the joints of the artist’s left hand were almost certainly affected by arthrosis, a disease that would have affected Michelangelo at the end of the seventh decade of his life. In the details of the portraits, we can see the nodules precisely, the typical deformities of arthrosis, the diagnosis of which offers a plausible explanation for Michelangelo’s loss of dexterity in old age and also underlines his victory over the disease. The continuous and intense work would have helped the artist to maintain the use of his hands as long as possible [28]. There are several studies that are represented in the scientific literature and that give us an idea of how to use a multidisciplinary team for research on particular pathologies and offer students suggestions for the development of clinical skills [29–31].

This brief description can give an idea of how art and medicine have a lot in common and how one can support the other. As you will see, art can promote the development of skills useful to doctors and medicine can help in understanding the history of the characters and communities represented but also be able to rewrite the history of art by suggesting other visions.

The experimentation of art as a tool in medical education is being carried out in many different countries. In Italy, at the Sapienza University of Rome, a special course that applies art practice was introduced in the curriculum of medicine and nursing. From the 2014–2015 academic year, a Sapienza research group began

experimenting this type of activities and currently the Laboratory of Art and Medical Humanities has been developed to coordinate art courses for the training of physicians and nursing and healthcare operators and continues in the context of study and research in this sector. The results were very interesting; even the activities organized in distance learning in the pandemic period were effective [32]. These courses are acquiring a curricular character with positive qualitative and quantitative results in line with those presented by the international literature of the sector.

These experiences also led to the validation of a useful grid to measure the improvement of some of the skills previously mentioned after participating in the proposed discussion and art production activities [33]. Other experiences in other countries reported the positive results obtained by adopting this useful evaluation system [34].

Other experiences in the field of continuing education, always in the health sector, have found a positive welcome by the attendants. In the United States, the use of works of art has become an approach used in the care sector by many universities to involve medical students, residents, doctors, and nurses in an innovative learning process. Medical schools are expanding their educational programs by collaborating with local art museums [35]. In Italy too, an experimentation linked to the activities applied in the United States is underway.

The last notation that is considered important to report is the one that is linked to these experiences carried out at a distance in period of COVID pandemic with extremely positive results in the various areas in which they have been applied—university environment, groups connected to palliative care, patients in psychotherapy, in distance teaching.

These experiences have helped to raise awareness of how much arts, and in this case visual art, can be a valuable tool for developing to upgrade useful skills and abilities in the care sector and improve the state of well-being of professionals in the medicine and healthcare field.

Author details

Vincenza Ferrara

Faculty of Pharmacy and Medicine, Sapienza University, Rome, Italy

*Address all correspondence to: vincenza.ferrara@uniroma1.it

IntechOpen

© 2021 The Author(s). Licensee IntechOpen. This chapter is distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited. 

References

- [1] Franceschini G. La Patologia umana nell'arte. EMPORIUM. 1906;**24**(144): 424-448
- [2] Dewey J. In: Boydston JA, editor. Art as Experience in Later Works of John Dewey, 1925-1953. Vol. 10. Carbondale: Southern Illinois University Press; 1987
- [3] Arnheim R. Visual Thinking. Berkeley: University of California Press; 1969
- [4] Gardner H. Frames of Mind. The Theory of Multiple Intelligences. New York: Basic Books; 2011
- [5] Report 67. What is the evidence on the role of the arts in improving health and well-being? A scoping review (2019). World Health Organization, WHO Regional Office for Europe, WHO Europe. 2019. Available from: <https://apps.who.int/iris/bitstream/handle/10665/329834/9789289054553-eng.pdf> [Accessed: 17 May 2021]
- [6] Grossi E, Tavano Blessi G, Sacco PL. Magic moments: Determinants of stress relief and subjective wellbeing from visiting a cultural heritage site. Culture, Medicine and Psychiatry. 2019;**43**(1): 4-24. DOI: 10.1007/s11013-018-9593-8
- [7] Bolwerk A, Mack-Andrick J, Lang FR, Dörfler A, Maihöfner C. How art changes your brain: Differential effects of visual art production and cognitive art evaluation on functional brain connectivity. PLOS One. 2014;**9**(7):e101035
- [8] Mangione S, Chakraborti C, Staltari G, Harrison R, Tunkel AR, Liou KT, Cerceo E, Voeller M, Bedwell WL, Fletcher K, et al., Medical students' exposure to the humanities correlates with positive personal qualities and reduced burnout: A multi-institutional U.S. survey. J Journal of General Internal Medicine. 2018;**33**:628-634.
- [9] Constitution of the World Health Organization. Available from: <https://www.who.int/about/governance/constitution> [Accessed: 17 May 2021]
- [10] Ottawa Charter. 1986. Available from: <https://www.who.int/teams/health-promotion/enhanced-wellbeing/first-global-conference> [Accessed: 17 May 2021]
- [11] Engel GL. The need for a new medical model (a challenge for biomedicine). Science. 1977; **196**:129-136
- [12] Mukunda N, Moghbeli N, Rizzo A, Niepold S, Bassett B, Delisser HM. Visual art instruction in medical education: A narrative review. Medical Education Online. 2019;**24**:1558657. DOI: 10.1080/10872981.2018.1558657
- [13] Ferrara V, De Santis S, Manicone F, Martinino A, Consorti F. The visual art as a learning tool in medical education. Senses and Sciences. 2020;**7**(2): 1028-1040
- [14] Zazulak J, Halgren C, Tan M, Grierson LE. The impact of an arts-based programme on the affective and cognitive components of empathic development. Medical Humanities. 2015;**41**:69-74
- [15] Housen A. Aesthetic thought, critical thinking and transfer. Arts Learn Res J. 2001;**18**(1):99-132.
- [16] Yenawine, P. *Visual thinking strategies: Using art to deepen thinking across school disciplines*. Cambridge, MA: Harvard Education Press; 2013.
- [17] Agarwal GG, McNulty M, Santiago KM, Torrents H, Caban-Martinez AJ. Impact of visual thinking strategies (VTS) on the analysis of

- clinical images: A pre-post study of VTS in first-year medical students. *The Journal of Medical Humanities*. 2020; **41**(4):561-572. DOI: 10.1007/s10912-020-09652-4
- [18] Polianski IJ, Fangerau H. Toward harder medical humanities: Moving beyond the two cultures dichotomy. *Academic Medicine*. 2012;**87**:121-126
- [19] Jacques A, Trinkley R, Stone L, Tang R, Hudson WA, Khandelwal S. Art of analysis: A cooperative program between a museum and medicine. *Journal for Learning through the Arts*. 2012;**8**:1-10. Available from: <http://www.escholarship.org/uc/item/36n2t2w9>
- [20] Vischer R. Über das optische Formgefühl. Ein Beitrag zur Ästhetik. Leipzig: Herman Credner [English edition: On the Optical Sense of Form: a Contribution to Aesthetics. In: Mallgrave, HF, Ikonomou E, editors. Empathy, form, and space: Problems in german aesthetics. 1873-1893. Santa Monica, California: Getty Center for the History of Art and the Humanities; 1994. pp 89-123.
- [21] Iacoboni M, Molnar-Szakacs I, Gallese V, Buccino G, Mazziotta JC, Rizzolatti G. Grasping the intentions of others with one's own mirror neuron system. *PLOS Biology*. 2005;**3**(3):e79
- [22] Bardes CL, Gillers D, Herman AE. Learning to look: Developing clinical observation skills at an art museum. *Medical Education*. 2001;**35**:1157-1161
- [23] Geller G. Tolerance for ambiguity: An ethics based criterion for medical student selection. *Academic Medicine*. 1990;**88**(5):581-584
- [24] Iannello P, Mottini A, Tirelli S, Riva S, Antonietti A. Ambiguity and uncertainty tolerance, need for cognition, and their association with stress. A study among Italian practicing physicians. *Medical Education Online*. 2017;**22**(1):1-10
- [25] Pontius A. Icono-diagnosis: A medical humanistic approach, detecting Crouzon's malformation in Cook Islands' prehistoric art. *Perspectives in Biology and Medicine*. 1983;**27**:107-120
- [26] Franco V. Icono-diagnosis: A challenge between medicine and art. *Senses and Sciences*. 2019;**6**(2):747-752
- [27] Barbado Hernández FJ. Una visita médica a Las Meninas. *El dentista del siglo XXI*. 2015;**5**:30-34
- [28] Lazzeri D, Castello MF, Matucci-Cerinic M, Lippi D, Weisz GM. Osteoarthritis in the hands of Michelangelo Buonarroti. *Journal of the Royal Society of Medicine*. 2016; **109**(5):180-183
- [29] Sterpetti AV, Fiori E, De Cesare A. Goiter in the Art of Renaissance Europe. *Am J Med*. 2016 Aug;**129**(8):892-895. DOI: 10.1016/j.amjmed.2016.04.015. Epub 2016 May 3. PMID: 27154774.
- [30] Ruggieri M, Gentile AE, Ferrara V, Papi M, Praticò AD, Mudry A, et al. Neurocutaneous syndromes in art and antiquities. *American Journal of Medical Genetics. Part C*; 2021;**187**(2): 224-234. DOI: 10.1002/ajmg.c.31917
- [31] Toriello H. Literature review: Genetic conditions or anomalies in artworks. *American Journal of Medical Genetics. Part C*; 2021;**187**(2):111-121. DOI: 10.1002/ajmg.c.31886
- [32] Ferrara V. L'arte come strumento per la formazione in area medica e sanitaria. 2020. Roma, Aracne
- [33] Ferrara V, De Santis S, Melchioril FM. Art for improving skills in medical education: The validation of a scale for measuring the visual thinking strategies method. *La Clinica Terapeutica*. 2020;**171**(3):e253-e259. ISSN 1972-6007
- [34] Agarwal GG, McNulty M. Santiago impact of visual thinking strategies

(VTS) on the analysis of clinical images:
A pre-post study of VTS in first-year
medical students. *The Journal of
Medical Humanities*. 2020;**41**:561-572

[35] Art and medicine resources. UT
Dallas University. Available from
[https://arthistory.utdallas.edu/
medicine/](https://arthistory.utdallas.edu/medicine/) [Accessed: 17 May 2021]