S&S

Senses Sci 2020: 7 (2): 1028- 1040
doi: 10.14616/sands- 2020-2-10281040

Article

The visual art as a learning tool in medical education

***Vincenza Ferrara[1], Sara De Santis[2], Francesca Manicone[3], Alessandro Martinino[3], Fabrizio Consorti[4]**

[1] Laboratory of Art and Medical Humanities, Pharmacy and Medicine Faculty, Sapienza University of Rome, Rome, Italy

[2]Department of Public Health, Rome, Italy

[3]Faculty of Medicine and Dentistry, Sapienza University of Rome, Rome, Italy

[4] Department of Surgical Sciences, Sapienza University of Rome, Rome, Italy

*Correspondence: Vincenza Ferrara, Master's Degree in Art History, Head of Art and Medical Humanities Lab, Sapienza University of Rome, 155 Viale del Policlinico, 00161, Rome, Italy. Email: vincenza.ferrara@uniroma1.it.

Abstract. The literature has identified promising findings regarding the application of methodology using visual art to develop the cognitive skill of observation and description to enhance critical thinking among medical students. This longitudinal controlled quasi-experimental study aims to demonstrate that Visual Thinking Strategies method and other art activities are effective in improving and maintaining the ability to observe, describe and critically interpret artistic or medical images in undergraduate medical students. The course of art and medicine was given at the 3rd, 4th, and 5th year at the same cohort of students within the curriculum of Medicine and Surgery of Sapienza University of Rome and a baseline pre-post assessment was performed using a validated rubric to score a written test on observation and interpretation of paintings and clinical images. All the students increased their score from pre to post-test in the 3rd year, but only the students attending the electives during the 4th and 5th year maintained their ability to observe, describe and critically interpret. Our findings suggest that The Visual Thinking Strategies, as arts-based learning activities, are an effective methodology to increase the professional abilities of medical students but if our findings are coherent with what is already known about the effectiveness of the observation of fine arts to increase clinical visual skills but it needs persistence of these activities. Therefore they should be added to medical curricula as a mandatory component.

Keywords: burnout, communication, critical thinking, medical education, Visual Thinking Strategies

Theory

There are many training needs in the medical and nursing field to improve observation, communication, ambiguity tolerance, and empathy skills tonarrowthe gap between the healthcare personneland the patient.Recoveringthe relation with medicine and using innovative teaching methods, the visual arts can be considered as a tool to learn and develop abilities, thus fulfilling these needs.[1,2,3]According to these reflections, since the '80s, particularly in the United States, academic courses based on the use of visual arts, are undertaken in medical and nursing education. The scientific literature suggests that this practice improves both observation and empathy. [4,5] The Visual Thinking Strategies (VTS)[6,7,8,9] and Artful Thinking[10,11,12] are the pedagogical methods usually employed. These methods aim to enhance observational skills, increase self-confidence, and improvephysical examination and diagnosis process.[13]

Furthermore, some researches have shown thatexposure to art allows stress reduction, increases self-empowerment and self-awareness, induces behaviour patterns to change, normalizing heart rate, blood pressure, or cortisol levels.[14,15]

The narrative reviews on this topic suggest that clinical practicewith the art observation's training requires further exploration, namely pre- and post-course surveys and assessments, using validated measures to gauge the areas potentially impacted by visual arts training. [1]

Hypothesis

The VTS method is based on a solid theoretical model [16] and it has been introduced in many academic programs of medical and nursing courses. Through a longitudinal controlled quasi-experimental study our goal is to investigate the long-term effect of VTS on visual ability and critical thinking related todiagnostic ability and empathy for the patients. The hypothesis is that these activities proposed may improve the skills useful for the medical practiceand that these skills may be measurable. This transversal learning method should be part of the medical curriculum and support the student during all the academic years to obtain effective results. We based the assessmentof the results on measuring the development of skills through the VTSkill grid. [17]

Methods

Context and course overview

In 2014 the research group on VTS application in Medical Educationhas been established atSapienza University of Rome. The group started introducing art activities in the academic courses of medicine and nursing, in the Family Medicine Residency, andthe Paediatric ward.From the academic year 2015 to 2016the researchers, in collaboration with the Head of Medicine and Surgery Degree "C" ofSapienza University of Rome, organized a trial using art activities for the 3rd, 4th, and 5th year medical students.The experimentation was run by the Art Laboratory for Medical Humanities, at the Faculty of Pharmacy and Medicine, whose purpose is to introduce

pedagogical methods for the basic formation in the medical and healthcare area, using the cultural heritage.The training activities of "The art for medical education" involved VTS as a pedagogical method and other art practices in order to improve the soft skills useful for medical education. A questionnaire to assess the impact of these activities onskills and empathy improvementwas givento the students and healthcare operators. For this project the research group has designed a scoring table (VTSkill grid), thus evaluatingtheVTS and art activities impact on skills improvement.[17]

During the academic years from 2016 to 2019, the application of Visual Thinking Strategies was tested in a three years longitudinal program named "The art of observation: from artwork to diagnosis"as part of the six years Medicine and SurgeryMaster Degree of Sapienza University of Rome. The whole program consisted of fifteen meetings from October 2016 to June 2019. The pilot program for the medical students of the 3rd year was insidethe Clinical Methodology and Semiotics Course. In the classroom and at the museum the VTS method and other practical art observations were applied. In the classroom session, the teachers explain the relation between Art and Medicine and how relevant is the power of observation. In the Museum and in theArt and Medical Humanities Lab the students were divided into small groups to work on observation and description of a painting, chosen by the research group and possibly unknown to them, followed by the application of theVTS method. The goals for this yearwasimproving observation, problem-solving, critical thinking, teamwork, and empathy.

The pilot program with the 4thyear's medical students was placed in the Anatomy Pathology and Public Health course as an elective. In the lab session the students, previously divided in small groups, workedon observation and description followed by the application of the VTS method on a painting,chosen by the research group, with pathognomonic details useful toidentify a certain disease, in the attempt of promoting an active diagnosis practice.During this yeara drawing activity was included.The aims for the 4th year elective were improvingobservation, active listening, critical thinking, problem solving, collaborative work, empathy and resilience.

The pilot program with the 5thyear medical students was set in the Internal Medicine and General Surgery 1 course,remaining an elective. In the classroom and at the museum the VTS method and drawing practice wereapplied. In the lab session the students, always divided into small groups, challenged themselves practicing observation and description of clinical images chosen by the research group for an active diagnosis practice, followed by the application of the VTS method.The goalsfor this year wereimproving observation, critical thinking, problem solving, collaborative work, empathy and resilience.

VTS and other art activities were implemented thanks to the direction of Art and Medical Humanities Lab in cooperation with some museums of Rome, i.e. La Galleria Nazionale, La Galleria Comunaled'ArteModerna, Il Museo di Roma di Palazzo Braschi, Il Museo Nazionale Etrusco, Il Museo Laboratoriod'ArteContemporanea, that joined the study and made their exhibitions and facilities available for free to students.

A typical VTS and Art practice session

A typical VTS session consisted of a small group meeting of 6 or 7 students in which an artwork is observed, and the following questions are asked, "What is going on in this picture?", "What visual elements support what you said?" and "What else can you see?".

The group is led by a facilitator, whose role includes asking questions, giving value to each student'scontribution to the discussion, summarizingonce in a while,and encouraging possible different interpretations. The supervisor has proven expertise in the application of the VTS method, as well as beingan expert in art or medical education. During a VTS session, any discussion about the artistic or historical value of the artwork is discouraged. The VTS program also encompasses other learning methodsaddressed to medical students such asiconodiagnosis, hearing active practice, and drawing.It is important to have an adequate number of sessions to achieve measurable results.

Research design

We designed a longitudinal controlled quasi-experimental study, [18] comparing two cohorts of students. A pre-test was given at the beginning of the 3rdyear where the students were divided into small groups and attended the mandatory VTS meetings. A post-test was then given at the end of the same year. At the beginning of the 4th year, students were asked to choose their electives and those whoenrolled in the elective courseof VTS were considered the "case" group, while all the remaining students were the "control" group. The enrolment in the VTS elective at the 5th year was only allowed to the students who attended the elective the year prior. The whole sample was composed of 62 students (37 female, 25 male), with a mean age of 22,5 in the 3rd year. At the beginning of the 4th year, 23 students (14 female, 9 male) chose to attend the VTS elective while the other 39 students(23 female,16 male) attended other electives usually offered during their 4th and 5th year. All the cases attendedthe VTS modules bothin the 4th and 5th year. Only two controls missed the final evaluation at the end of the 5th year. The same artistic and clinical images have been givento all the students divided into small groups. These non-abstract images were characterized by many details with a certain degree of ambiguity. Art experts and VTS facilitators guided the procedure during the VTS sessions, joinedby physicians for the clinical images for the fifth-year students. The physicians were experts of the pathologies shown in the clinical image (eg Dermatologists for Dermatology subject) and they evenhelped the facilitator to describe the connection with the pathology representedin the paintings with pathognomonic details.

Assessment and data collection

We assessed visual skill and critical thinking with the VTS Skill Italian validated rubric. [17] The rubric is composed of four domains: critical thinking, observation skill, written communication, and problem solving. Each domain is scored from 0 to 4, according to a set of criteria. The scores are summed to produce the final score. The assessment consisted of a written analysis of two images: a painting (test 1) and a clinical image (the photograph of the neck of a man - test 2). The pre-test was administered before starting the 3rd year's VTS sessions, whereas the post-test was administered in the classroom after finishing the VTS sessions at the end of the 3rd and 5th years. The post-test was equally given to both the students who participated in the VTS sessions during the past years and those who did not participate.Two trained evaluators assessed the texts and computed the score. The count of words of texts and the number of elements identified in the image and described in the text were also recorded, as secondary outcome measures.

Statistical analysis

Numerical data were treated as continuous data, reported as mean, standard deviation, and with a 95% confidence interval. The difference of mean between two groups in a single point of time was evaluated with the Student t test. The difference between the case-control groups in the time series for each test was compared with mixed ANOVA for repeated measures. The strength of the correlation between the score of test1 and test 2 was evaluated with the Pearson correlation coefficient (0-0.30 weak; 0.31-0.60 mean; 0.61-1 strong). All the differences were considered significant if the alpha error probability was lower than 0.05. The calculation was done with SPSS ver.25.

Ethical approval

The study was approved by the technical-pedagogical commission (CTP), which is the entity in charge of the organization and planning of the curriculum. Since all the activities were normal activities encompassed in the study plan and there was no randomization of students, formal approval from the ethical committee was not needed.

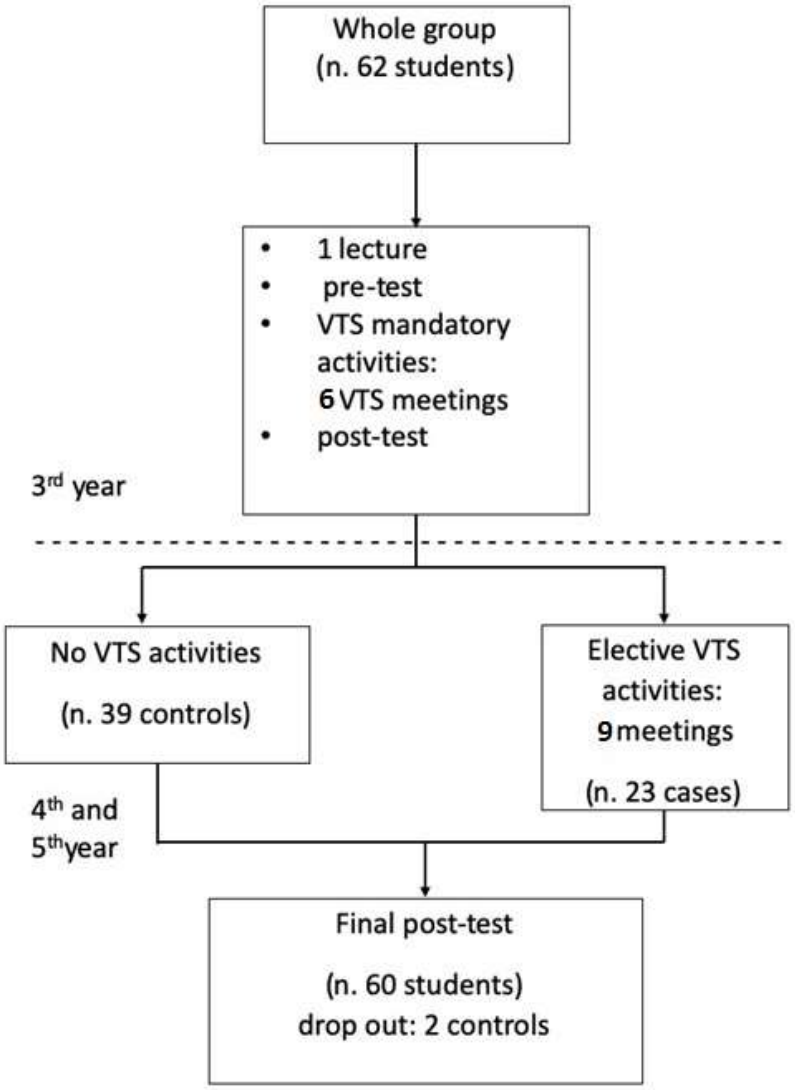
Results

The mean total score of pre-assessment for the whole class of students was 6.54 (SD ±1.17; CI 6,06-7,01) for test 1 and 5.38 (SD ±3.28; CI 4.10-6.67) for test 2. The score increased in a significant way at the end of the year: 7,26 (SD ± 3.28; CI 6.42- 8.09) for test 1 and 6,63 (SD ± 0.41; CI 5.81-7.45) for test 2 ($p<0.01$ for both test 1 and test 2).

When the analysis was stratified for gender, there was nota difference between women and men.

Tables 1 and 2 show the descriptive statistics and the mixed ANOVA for the score of case-controls groups for the time series at 3rdand 5thyear, respectively for test 1 (artistic image) and test 2 (clinical image). The difference of the mean score of the pre-test betweenthe case-control groups was significant, both for test 1 and test2, but both groups reached the same level of proficiency at the end of the year. There was a significant increase of score from 3rd to 5th year for cases, while controls increased their score at the end of the3rdyear but at the final test decreased their score at the same level of the pre-test. **(Figure 1).**

FIGURE 1. The flow of the experiment.



We observed the same trend also for the secondary outcomes: both for test 1 and test 2, the number of words and the number of identified elements increased at the end of the 3rd year, then decreased for controls and were maintained for cases **(Table 3).** The correlation between the score of the whole cohort for test 1 and 2 at the end of the 3rd and 5th year was respectively 0.414 and 0.409 ($P< 0.01$).

TABLE 3 - Descriptive statistics for the number of words and identified elements in test 1 (artistic image) and test 2 (clinical image)

Number of words		**Mean**	**SD**	**95% CI**		**Mean**	**SD**	**95% CI**	
		Test 1				**Test 2**			
Pre-test	Controls	50,80	19,67	26.37	75.23	31.00	7.52	21.67	40.33
	Cases	63,67	25,69	51.97	75.35	43.57	17.31	35.69	51.45
End 3rdy	Controls	65.51	24.69	57.51	73.52	45.54	17.28	39.78	51.30
	Cases	70.74	21.82	61.30	80.18	42.30	17.39	34.78	49.83
End 5th	Controls	41.97	17.92	36.16	47.78	27.84	13.21	23.43	32.25
year	Cases	67.96	22.01	58.44	77.47	42.74	14.87	36.31	49.17
Number of elements									
Pre-test	Controls	6.20	2.28	3.37	9.03	3.40	1.52	1.52	5.28
	Cases	8.67	2.85	7.37	9.96	6.14	2.57	4.97	7.31
End 3rd	Controls	7.87	2.99	6.90	8.84	5.03	1.72	4.45	5.60
year	Cases	9.09	2.74	7.90	10.27	5.30	2.01	4.44	6.17
End 5th	Controls	6.44	2.73	5.55	7.32	3.89	1.73	3.32	4.47
year	Cases	9.04	2.21	8.09	10.00	5.61	2.41	4.57	6.65

Abbreviations: CI, confidence interval; SD, standard deviation.

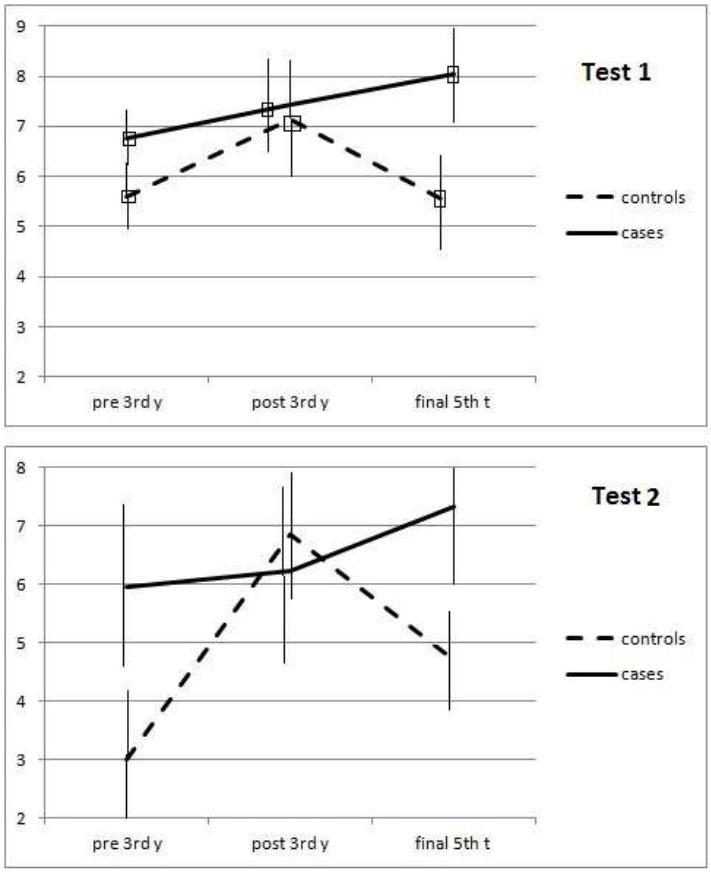
Mixed ANOVA: P<0.05 between groups both for the number of words and of elements, for both tests.

The correlation between the score of the whole cohort for test 1 and 2 at the end of the 3rd and 5th year was respectively 0.414 and 0.409 ($P< 0.01$).

Discussion

The VTS program was effective in increasing the visual skill of the whole sample of students at the end of the 3rd year.The VTSkill grid also measured the positive impact of the VTS program on improving problem solving, linguistic expression, and critical thinking skills for medical students. These effectswerenot persistent and two years later only the students who attended the two elective VTS courseskept their ability to observe and critically interpret an artistic or clinical image **(Figures 2).**

FIGURE 2 - Temporal trends of the score of test 1 and test 2 for cases and controls: mean and confidence interval.



We observed a significant difference between controls and cases in the pre-test score for test 1 and test 2 **(Tables 1 and 2).**

ORCID ID

https://orcid.org/0000-0001-6371-2038

TABLE 1- Descriptive statistics for test 1 (artistic image).

		Mean	SD	95% CI	
				Lower	Higher
Pre-test	controls	5,60	0,55	4,92	6,28
	cases	6,76	1,18	6,23	7,30
End 3rd year	controls	7,15	3,77	5,93	8,37
	cases	7,43	2,31	6,43	8,43
End 5th year	controls	5,41	2,49	4,60	6,22
	cases	8,04	2,12	7,13	8,96

Note.Student t-test for the mean score of the pre-test between controls and cases.

Abbreviations: CI, confidence interval; SD, standard deviation.

Mixed ANOVA: P<0.05 within subjects and between groups.

TABLE 2 - Descriptive statistics for test 2 (clinical image).

		Mean	SD	95% CI	
				Lower	Higher
Pre-test	controls	3,00	1,00	1,76	4,24
	cases	5,95	3,28	4,46	7,44
End 3rd year	controls	6,86	2,97	5,87	7,86
	cases	6,23	3,45	4,70	7,76
End 5th year	controls	4,70	2,61	3,83	5,57
	cases	7,32	3,11	5,94	8,70

Abbreviations: CI, confidence interval; SD, standard deviation.

Mixed ANOVA: P<0.05 within subjects and between groups

Student t-test for the mean score of the pre-test between controls and cases (P< 0.01).

This could imply that students who chose to attend the VTS electives during the 4th and 5th year (treated as the "cases") had a previous stronger attitude to engage in this kind of activity and/or a higher level of basic visual skills. Nevertheless, both groups reached the same level of proficiency at the end of the 3rd year.

The mean score for test 1 was higher than for test 2, as well as the number of words and the number of identified elements. The mild but significant correlation between the score of test 1 and test 2 suggests that they measure related but not identical skill.

Our findings are coherent with what is already known about the effectiveness of the observation of fine arts to increase clinical visual skills. Some studies inquired about the effect of art observation on visual skill with a non-controlled pre-post experiment [19,20] and they could show a significant effect. Only three quantitative controlled studies are available [10,13,21] based on a pre-post test design after an arts-based intervention. In these studies, the intervention was based on a set of sessions of observation and description of arts, but none of them considered the persistence of the effect. Our data show that only a repeated series of interventions along the curricular years can maintain the effect on visual skill. In support of this statement, Naghshineh et al. noted that the effect in their experiment had a dose-response relationship with the number of sessions the students attended. [13]

The problem of curricular integration of arts-based learning activities has been already addressed. In their commentary about medical humanities in medical education, Wald et al. support a longitudinal integration of arts in medical curricula and argue that "Tension regarding how to place MH within medical curricula exists, and the argument that medical curriculum is already over-burdened is a strong one [...] Nevertheless, even within this tension, reasonable proposals exist". [22] At this regard, Haidet et al. proposed a conceptual framework to guide design, evaluation, and research in arts-based education. [23] Their model built upon four "stepping stones" (quality of arts, engagement, construction of new meanings, translation to practice), incorporates the idea of a progression along the time that calls for a longitudinal integration of arts-based activities.

Limitations

This study has some limitations. Firstly, the total number of participants, based on a single-classcohort, is not wide enough to allow for a generalization of the results. Nevertheless, methods and results are robust enough to provide a sound rationale for a wider, multicentre, even cross-cultural study. The study would need to be extended to a wider and more representative population of Italian students to collect the normative values for the two types of tests.

Secondly, the study is controlled but not randomized and this might have introduced aselection bias. The two groups of students were similar in age and genderbut showed a different pre-test mean score, even if the two groups reached the same level of proficiency at the end of the 3rd year. This design was imposed by the present structure of our academic curriculum, which does not allow a prosecution of the mandatory VTS modules during the 4th and 5th year. We were mainly interested in observing the persistence of the effect after the 3rd year, so we accepted this limitation

Conclusions

Art-based learning activities, namely the Visual Thinking Strategies, are effective in promoting several abilities deemed professionally relevant like visual skills, problem solving, critical thinking, empathy, team building, resilience, and cultural sensitivity. [1] To obtain significant educational effects, it is important to carefully integrate these activities into the overall curricular design. A major issue is also devising a large multicentre quantitative and qualitative study to define the best teaching methods and the needed amount of exposure to art-based activities, to avoid them being only an option inthe educational process.[24] The results of this experience showa clear impact even from short exposure to this transversal learning method. In conclusion, we highlight the need for the persistence of these activities over the academic years and we support the utmost importance ofg reater inclusion of visual arts training in medical education.

Acknowledgements

We thank Arianna Angelelli member of the Galleria Comunale di Arte Moderna e Contemporanea di Roma, Cristiana Collu and Emanuela Garrone Director and member of the Galleria Nazionale respectively, Filippo Maria Gambari and Gianfranco Calandra Director and member of the Museo delle Civiltà (Muciv) respectively, Fulvia Strano member of the Museo di Roma, Claudio Zambianchi and Ilaria Schiaffini, Directors of the Museo Laboratorio di Arte Contemporanea of Sapienza University of Rome and Valentino Nizzo and Francesca Licordari, Director and member of the Museo Nazionale Etrusco repectively.
We thank VTSItalia and all the tutors who joined the VTS sessions.

Conflict of interest

The authors declare that no conflict of interest could be perceived as prejudicing the impartiality of the research reported.

Author contributions

Vincenza Ferrara and Sara De Santis designed the curriculum and the experiment, gave the lectures, supervised the meetings, edited and approved the manuscript.
Francesca Manicone and Alessandro Martinino supervised the meetings, edited and approved the manuscript.
Fabrizio Consorti designed the experiment, did statistical analysis, drafted the manuscript.

Funding Information

The author(s) received no financial support for the research, authorship, and/or publication of this article

References

1. Mukunda N, Moghbeli N, Rizzo A, Niepold S, Bassett B, DeLisser M H. Visual art instruction in medical education: a narrative review. Medical Education Online. (2019) 24:1, 1558657, DOI: 10.1080/10872981.2018.1558657
2. Wellbery C, McAteer RA. The Art of Observation: A Pedagogical Framework. Acad Med. 2015 Dec;90(12):1624-30. 10.
3. Perry M, Maffulli N, Willson S, Morrissey D. The effectiveness of arts-based interventions in medical education: a literature review. Med Educ. 2011 Feb;45(2):141-8.
4. De Santis S, Giuliani C, Staffoli C, Ferrara V. Visual Thinking Strategies in nursing: A systematic review. Senses and Sciences.2016 :3 (4):297-302. Doi: 10.14616/sands-2016- 42973-2
5. Ferrara V, De Santis S, Staffoli C, Art and Medicine: from anatomic studies to Visual ThinkingStrategies, Senses and Sciences.2015; 2 (1):40-44
6. Hailey D, Miller A, Yenawine P. Understanding visual literacy: The visual thinking strategies approach. In D. M. Baylen, & A. D'Alba (eds.), *Visualizing learning: essentials of teaching and integrating visual and media literacy.* New York: Springer. 2105.
7. Miller A, Grohe M, Khoshbin S, Kats JT. From the galleries to the clinic: applying art museum lessons to patient care. J Med Humanit. 2013;34(4):433–438.
8. Klugman CM, Peel J, Beckmann-Mendez D. Art rounds: teaching interprofessional students visual thinking strategies at one school. Acad Med. 2011;86 (10):1266–1271.
9. Reilly JM, Ring J, Duke L. Literature and the arts in medical education. Fam Med. 2005;37(4):250–252.
10. Gurwin J, Revere KE, Niepold S, et al. A randomized controlled study of art observation training to improve medical student ophthalmology skills. Ophthalmology. 2018;125(1):8–14.
11. Overview: Artful Thinking. [cited 2018 Mar 1]. Available from: http://pzartfulthinking.org/?page_id=5
12. Project Zero. Artful thinking final report. Harvard Grad Sch Educ. 2006;115. Available from: http://www.pz .harvard.edu/sites/default/files/ArtfulThinkingFinalReport-1.pdf
13. Naghshineh S., Hafler JP, Miller AR, Blanco MA, Lipsitz SR, Dubroff RP, Khoshbin S., Katz JTFormal art observation training improves medical students' visual diagnostic skills. Journal ofGeneral Internal Medicine.2008; 23: 991-997
14. 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 brainconnectivity. PLoS One. 2014 Jul 1;9(7):e101035.
15. Mangione S, Chakraborti C, Staltari G, Harrison R, Tunkel AR, Liou KT, Cerceo E, VoellerM,Bedwell WL, Fletcher K, Kahn MJ. Medical Students' Exposure to the Humanities

Correlates withPositive Personal Qualities and Reduced Burnout: A Multi-Institutional U.S. Survey. J Gen InternMed. 2018 May;33(5):628-634.

16. Housen A. Validating a Measure of Aesthetic Development for Museums and Schools. ILVS (International Laboratory for Visitor Studies. A Journal of Visitor Behavior. 1992;2(2):213-237.
17. Ferrara V., De Santis S., Melchiori FM. Art for improving skills in medical education: the validation of a scale for measuring the Visual Thinking Strategies method. **La ClinicaTerapeutica**, [S.l.], 2020; 171(3); 253- 59.
18. Scher L, Kisker E, Dynarski M. Designing and Conducting Strong Quasi-Experiments in Education - Version 2. ED561293. 2015. http://files.eric.ed.gov/fulltext/ED561293.pdf.
19. Bardes CL, Gillers D, Herman AE. Learning to look: developing clinical observational skills at an art museum. Med Educ. Dec 2001;35(12):1157-61.
20. Jasani SK, Saks NS. Utilizing visual art to enhance the clinical observation skills of medical students. Med Teach. 2013;35(7):1327-31.
21. Dolev JC, FriedlaenderKrohner L, Braverman IM. Use of Fine Art to Enhance Visual Diagnostic Skills. JAMA. 2001;286(9):1020-1021.
22. Wald HS, McFarland J, Markovina I. Medical Humanities in medical education and practice. Medical Teacher. 2019;41(5):492-496.
23. Haidet P, Jarecke J, Adams NE et al. A guiding framework to maximise the power of the arts in medical education: a systematic review and meta-synthesis. Medical Education. 2016;50(3):320-331.
24. Kumagai AK. Beyond "Dr Feel-Good": A Role for the Humanities in Medical Education. Acad Med. 2017;92(12):1659-1660.