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Visual art-based training in undergraduate medical education: A systematic review

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ABSTRACT

Background: Visual art has been increasingly incorporated into medical education and has been shown to enhance important competencies, such as empathy. However, limited evidence on effective visual art program design and evaluation processes remain. This systematic review examines the format, content, and espoused outcomes of visual art-based training programs in undergraduate medical education.

Methods: A comprehensive literature search of MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, and ProQuestERIC on undergraduate medical education and visual arts retrieved 1703 articles published from 2014 to 2020. After reviewing inclusion and exclusion criteria, 23 articles were chosen for full review and synthesis.

Results: Program format and content varied, ranging from 1-day specific competency focused programs to well-structured comprehensive 6–12-week programs. 6 areas of program foci were identified: observation skills, empathy, tolerance to uncertainty, cultural sensitivity, team building and collaboration, and wellness and resiliency. Although several programs used validated measures to assess skills acquisition, they seldom addressed long-term outcomes.

Conclusions: Our findings indicate that visual art-based education hold a promise to enhance important competencies in medical education, particularly empathy. Clinical observation, in particular, had the strongest evidence of its effectiveness compared to the other competencies. Future programs incorporating visual arts will benefit from a longitudinal (greater than 6 weeks) program which incorporates guided artworks, reflection exercises, and a group discussion to provide a stronger foundation for the development of core competencies. We propose using validated scales to measure outcomes in future studies and follow-up with participants to better assess Kirkpatrick Level 3 and 4 outcomes.

KEYWORDS
Visual art; art-based training; undergraduate medical education

Introduction

Medical schools around the world have historically focused on building knowledge and technical competencies with little attention to engaging students in a holistic and humanistic way (Haidet et al. 2016). There is a lack of intentional training in empathy, cultural sensitivity, clinical observation, tolerance to uncertainty, and resilience (Mukunda et al. 2019). Yet, these are foundational elements of the practice of medicine and vital cornerstones of high-quality health care (Buck et al. 2015). A recent systematic review suggested that 50% of medical students are experiencing burnout (Frajerman et al. 2019) and studies have also shown a decline in empathy among medical students (Patel et al. 2019). These skills are difficult to teach using traditional teaching approaches (Haidet et al. 2016; Mukunda et al. 2019).

Arts-based training, an evolving area in undergraduate medical education, provides alternative means to engage learners and teach these critical skills (Mukunda et al. 2019). Literature has shown that involving creative arts in the health profession education leads to better medical practice (Haidet et al. 2016). Almost 70 medical schools worldwide offer arts-based training for their medical students including the USA, Austria, Canada, and Italy (Haidet

Practice points

- Visual art-based undergraduate medical education programs can be used to teach competencies such as: empathy, uncertainty tolerance, clinical observation skills, cultural sensitivity, collaboration and wellness/resilience.
- To provide a stronger foundation for the development of these competencies, programs should be both longitudinal and incorporated into the mandatory medical curriculum.
- Collaboration with local museums and visual-art experts can enrich the student learning experience.
- Guided artwork observation, reflection exercises, and group discussion can be used to facilitate teaching of these core competencies.

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Supplemental data for this article can be accessed here.

et al. 2016). Initiatives focused on visual art training with emerging research report its effectiveness in enhancing observational and diagnostic skills, empathy, tolerance of uncertainty, and team building (Buck et al. 2015; Haidet et al. 2016; Mukunda et al. 2019). Visual art-based education is defined as 'the use of visual art including; drawing, painting, sculpture, and use of images, symbols, and metaphors, in various adult education contexts' (Haidet et al. 2016). In general, visual art-based medical education is under-represented in the literature. Many gaps exist on how to incorporate visual art training into the medical curriculum and what the most effective frameworks to guide process design and outcome measurement is (Haidet et al. 2016; Mukunda et al. 2019). The last systematic review published on the same topic was conducted in 2014. This systematic review presented a conceptual model that may help to guide using arts in medical education by suggesting that the quality and complexity of art can engage learners in an interactive and reflective way (Haidet et al. 2016). This paper aims to evaluate publications subsequent to then to evaluate what has been added to the literature.

The objective of this systematic review is to explore the literature and identify the format, content, and evaluation of any existing art-based training programs in undergraduate medical education to help provide guidance to future program design. This exploratory research method was intentionally chosen given the lack of robust research published in this area specifically in design and evaluation processes.

Methods

Data sources

This systematic review focuses on literature that identifies the format, content, and evaluation of any existing art-based training programs in undergraduate medical education. A literature search was conducted using four databases: MEDLINE (OvidSP); EBM reviews-Cochrane Central Register of Controlled Trials; EMBASE Classic + EMBASE; and ProQuestERIC (Educational Resources Information Center) with support from a research librarian. Both subject headings and text word terms were used to search for articles on Undergraduate Medical Education AND Visual Arts Based Education. The search has been limited to the English language and to those articles published from 2014 to 2020. No age group was incorporated into the search. All references were saved in Mendeley library. Duplicate articles were eliminated. For a full search strategy, see Supplementary Appendix A (Figure 1).

All original studies which described the format, content, and evaluation of visual art-based training programs for medical students were included. All articles specific to medical students or undergraduate medical education were also included. Any studies prior to 2015, those describing programs involving only residents, physician faculty, or interprofessional healthcare workers and studies that were not original research articles were excluded. Studies that did not explicitly comment on curriculum design, content, or evaluation, were not available online or addressed other forms of art were excluded.

Study selection and appraisal

The preliminary search using four databases identified many articles using arts in medicine and touched upon different dimensions of humanism. Therefore, we decided to combine the term 'humanism' with arts-based terms to ensure that we capture all articles related to visual arts training. The initial search identified 1703 unique references. Three independent reviewers performed a title and abstract screen as well as a full-text review. The quality of the selected articles was critically appraised using either the Critical Appraisal Skills Programme (CASP) qualitative checklist (for qualitative or mixed methods studies) (Critical Appraisal Skills Programme. CASP 2018) or the Medical Education Research Study Quality Instrument (MERSQI) (for quantitative studies) (Reed et al. 2009; Cook and Reed 2015). The MESRQI score is 10-item scale provides a measure of methodological quality across 6 domains: study design, sampling, type of data, validity evidence, data analysis, and outcomes (Cook and Reed 2015). The total maximum MERSQI score allowed is 18 points (Reed et al. 2009; Cook and Reed 2015). Any disagreement over the eligibility of particular studies were resolved between the reviewers through group discussions. Titles and abstracts were examined for relevance, and 41 studies underwent full-text and bibliography review. Of the 41 full-text reviews, 23 met the inclusion criteria. The PRISMA chart of study is demonstrated in Figure 1. The 3 review authors extracted data independently, and any discrepancies were identified and resolved through discussion.

Synthesis. The program format and content were listed as described in the reviewed articles. Variables were extracted according to Table 1 column headings. Program evaluation and impact was organized according to Kirkpatrick's Model (Table 2).

1. Program format

Synthesis. The program format and content were listed as described in the reviewed articles. Variables were extracted according to Table 1 column headings. Program evaluation and impact was organized according to Kirkpatrick's Model (Table 2).

1. Program format. Ten articles described programs that were delivered longitudinally over 6–12 weeks (Balemans et al. 2016; Bramstedt 2016; Abidi et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; Lyon et al. 2018; Cracolici et al. 2019; He et al. 2019; Maatman et al. 2020) and 1 program was delivered over 2 years (Jones et al. 2017). Six of these programs were graded as pass or fail (Abidi et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; He et al. 2019), 2 assigned a grade (Balemans et al. 2016; Bramstedt 2016), 1 was non-credited (Cracolici et al. 2019), and 2 did not indicate the marking scheme (Lyon et al. 2018; Maatman et al. 2020). Eight of the 11 longitudinal programs were integrated within the existing undergraduate medical curriculum (Balemans et al. 2016; Bramstedt 2016; Abidi et al. 2017; Jones et al. 2017; Grogan and Ferguson 2018; Lyon et al. 2018; He et al. 2019; Maatman et al. 2020), and 2 others were optional offerings outside of the traditional curriculum (Gurwin et al. 2017; Cracolici et al. 2019). One program, offered to students at 2 different schools, was

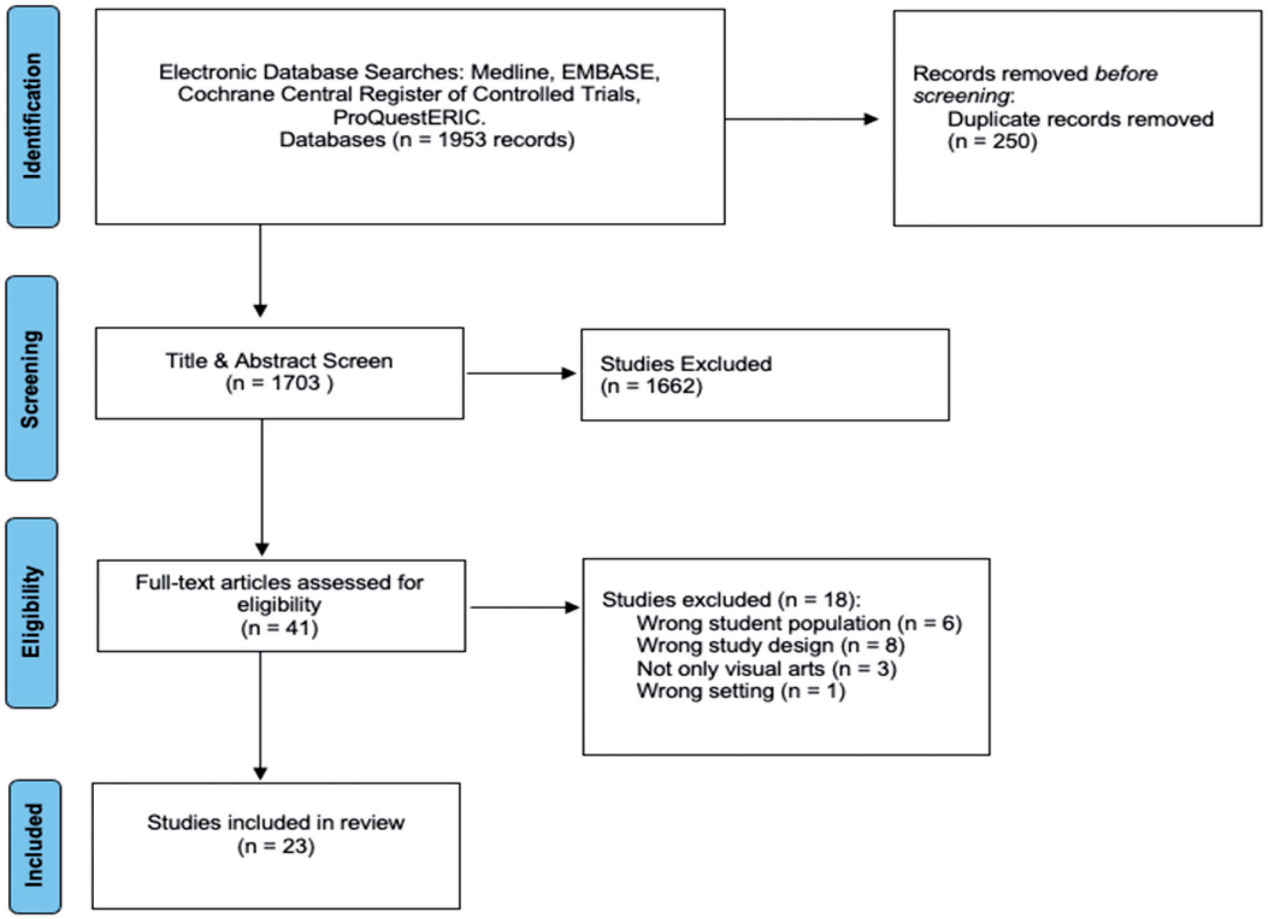

Figure 1. Prisma chart with study selection.

incorporated into the curriculum for 1 school and optional for the other (Gowda et al. 2018). Twelve of the remaining articles described programs that were shorter in duration, ranging from a 90-minute session to a 4-week program (Potash et al. 2014; Green 2015; Roberts and Noble 2015; Kidd et al. 2016; Potash et al. 2016; Tsao and Yu 2016; Backhouse et al. 2017; Bentwich and Gilbey 2017; Centeno et al. 2017; Godley et al. 2020; Masel et al. 2020; Strohbehn et al. 2020; Nash et al. 2021). Six of these studies were compulsory (Potash et al. 2016; Backhouse et al. 2017; Bentwich and Gilbey 2017; Godley et al. 2020; Masel et al. 2020; Strohbehn et al. 2020), 6 were electives (Green 2015; Roberts and Noble 2015; Kidd et al. 2016; Tsao and Yu 2016; Centeno et al. 2017; Godley et al. 2020) and 1 did not indicate (Nash et al. 2021). Seven of the 23 studies also involved guided visits to a local museum (Roberts and Noble 2015; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; He et al. 2019; Godley et al. 2020; Strohbehn et al. 2020). These collaborations were facilitated by clinicians and museum educators, with the latter typically taking the lead on the instruction during the individual sessions.

Various teaching methods were used, both across and within programs: didactic lectures (Balemans et al. 2016; Bramstedt 2016; Bentwich and Gilbey 2017; Gurwin et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; He et al. 2019), small and large group discussion (Bramstedt 2016; Kidd et al. 2016; Abidi et al. 2017; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Lyon et al. 2018; He et al. 2019; Godley et al. 2020), case studies (Kidd et al. 2016; Centeno et al. 2017; Gurwin et al. 2017), self-reflection (Bramstedt 2016; Kidd et al. 2016; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Jones et al. 2017; Gowda et al. 2018; He et al. 2019; Godley et al. 2020), painting (Grogan and Ferguson 2018; Lyon et al. 2018), guided art observation of artworks (Bramstedt 2016; Kidd et al. 2016; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Lyon et al. 2018; He et al. 2019; Godley et al. 2020) workshops (Bramstedt 2016; Kidd et al. 2016; Gowda et al. 2018), and an art exhibit (Bramstedt 2016) were all utilized. However, 11 described a curriculum in which students observed and interpreted artworks (painting, photography, sculpture, and drawing) and engaged in an interactive and reflective way through self-reflection exercises and/or group discussions to consider alternative perspectives and encourage collaborative thinking (Roberts and Noble 2015; Bramstedt 2016; Kidd et al. 2016; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; He et al. 2019; Godley et al. 2020; Masel et al. 2020; Strohbehn et al. 2020). Four programs analyzed the use of drawing for knowledge retention in anatomy and histology courses (Balemans et al. 2016; Backhouse et al. 2017; Grogan and Ferguson 2018; Cracolici et al. 2019). Ten programs described a curriculum in which students were involved in drawing, painting, or art creations (Green 2015; Balemans et al. 2016; Kidd et al. 2016; Potash et al. 2016; Backhouse et al. 2017; Jones et al. 2017; Grogan and Ferguson 2018; Lyon et al. 2018; Cracolici et al. 2019; Maatman et al. 2020). Depending on the duration of the program, the number and the type of teaching methods used varied. For

Table 1. Visual art training program descriptions and demographics.

Demographics			Program description		
Study	Number of trainees	Participants	Content/skills	Duration	Format
Abidi et al. 2017, Pakistan	28 – 26 per cohort	1st year Medical Students (from now on MS)	Moral and ethical values, emotional memory.	6 weeks (3 sessions per week)	Elective film course, facilitated by four faculty members, one of whom was a film expert. Students prepared interactive session to discuss and debate selected film.
Backhouse et al. 2017, UK	177 and 115 per cohort	1st–2nd MS	Improved test scores and anatomy knowledge.	2 weeks (2 sessions per week)	Anatomical image shown and students were encouraged to reflect on what they were shown and draw it.
Balemans et al. 2016, US	198 and 180 per cohort	1st MS	Knowledge retention.	12 weeks (160 study hours)	Exploring various anatomical regions. Lectures, self-study assignments, students viewed and draw histological images.
Bentwich and Gilbey 2017, Israel	67	1st MS	Empathy, tolerance for uncertainty, visual thinking, self-reflection.	90 min	Combined lecture and interactive discussions about art images, small group discussion.
Bramstedt 2016, Australia	93	2nd MS	Observational skills, visual literacy, teamwork, reflective and teamwork.	3 months	Workshop and a mixed art creation, reflective assay.
Centeno et al. 2017, Spain	20 per cohort	2nd–6th MS	Empathy, patient-centered care, wholistic care decision-making.	20 hours	Guided museum visits, reflections on art, case studies, didactic sessions, reflective trigger videos and group discussions.
Cracolici et al. 2019, US	25	1st MS	Observational skills, reflective writing, wellness.	3 months	Students given art supplies intermittently through the course and encouraged to draw, sketch, paint histological images.
Godley et al. 2020, US	64	1st MS	Empathy, ability to address racial issues, critical reflection.	90 minutes	Students visited art museum, engaged in facilitated discussion and reflection on art with racially-charged content.
Gowda et al. 2018, US	47	1st MS	Uncertainty, wellness, teamwork, observational skills, reflective capacity.	6 weeks 2 hr/wk.	Guided museum visits, self-reflection, short weekly assignments, final presentation relating an artwork.
Green 2015, US	7–9 per cohort	4th MS	Empathy, compassion, critical analysis, understanding the illness experience, communication.	4 wks (20 hours)	Structured seminars twice weekly to discuss graphic narratives, reflect, refine drawing, and create own final project.
Grogan and Ferguson 2018, US	112	1st–4th MS	Observational skills, visual-perceptual ability, enhance three dimensional (3 D) spatial understanding of the body's interior.	3 months (8 sessions)	'Art and anatomy' elective course, (drawing bones, drawing own hands).
Gurwin et al. 2017, US	63	1st MS	Observational skills, reflective capacity, empathy.	6 weeks (1.5 hr/wk.)	Art observation sessions, retinal pathology images, and external photographs of eye diseases, group discussion.
He et al. 2019, US	92	1st, 3rd MS	Observation skills, wellness, self-reflection, empathy, cultural sensitivity, wellness.	7 weeks 2 hr/wk.	Guided Museum visits, grounded theory to generate a thematic codebook, then employed axial coding to discover thematic relationships.
Jones et al. 2017, US	17	2nd–3rd MS	Empathy, personal growth, teamwork, collaboration, enhanced reflection.	2 years	Longitudinal patient relationship with interviews, reflections, and creation of an 'Interpretive Project' (e.g.

(*continued*)

Table 1. Continued.

Demographics			Program description		
Study	Number of trainees	Participants	Content/skills	Duration	Format
					painting, sculpture, film, poetry).
Kidd et al. 2016, Canada	20	1st MS	Empathy, issues around vulnerable persons, VTS.	2 hr	Interdisciplinary group workshop (discomforting oil portrait, painting), reflective writing, group discussion.
Lyon et al. 2018, UK	Not indicated	Undergraduate MS	Learning, education, collaboration, team work, expression, creativity.	8 weeks (24 hours)	One 3-hour session per week where students would engage in a drawing exercise led by a tutor followed by a discussion and dialogue.
Maatman et al. 2020, US	290	1st–4th MS, PGY1	Burnout; stress management.	10 sessions between 75 and 120 min.	Comic course where students draw 'something stressful in medicine.'
Masel et al. 2020, Austria	506	5th MS	Addressing challenging situations within medical settings.	1 session (time not indicated)	Medical comics (MCs), a blended learning setting via the Moodle online platform.
Nash et al. 2021, Australia	49 and 16 per cohort	1st MS	Seeking help for depression and mistreatment, understanding mandatory reporting.	3 hours	A workshop for health care students that used filmed vignettes
Potash et al. 2016, Honk Kong	180	3rd MS	Well-being; managing psychological stressors.	2.5 hours	Workshop in an art studio creating mandalas, reflection on their current psychological state. An art therapist facilitated.
Roberts and Noble 2015, US	20	1st MS	Perceptions/attitudes of dementia, empathy.	1.5 hours	A museum-based art-centered program designed to engage patients with dementia and caregivers
Strohbehn et al. 2020, US	34	3rd–4th MS	Empathy, tolerance for ambiguity, mindfulness, resilience, compassion.	2 weeks (3 hours)	Sessions used visual art to explore themes in internal medicine. The sessions were guided by a tutor.
Tsao and Yu 2016, Canada	25	1st–2nd MS	Empathy, improved clinical outcomes in diabetes management.	4 hours	An online animated comic strips on diabetes management - affects learning processes for empathy in medical students

Table 2. Key components to visual arts in medicine courses.

Domain	Approaches
Clinical observation	Guided art observation (photography, drawing, painting), session on clinical correlations, reflective training, focused observational sketches.
Empathy	Exercises that promoted self-reflection, active recognition of emotion in artworks, appreciation of the patient experience and/or sessions on topics like ethical issues and empathy.
Wellness/resilience	Through drawing exercises, reflective writing, management of psychological stressors, and/or encouragement of mindfulness of artworks.
Tolerance for uncertainty	Reflective skills, recognizing and examining uncertainty enhancement of tolerance for ambiguity.
Cultural sensitivity	Exercise that encourage students to share various perspectives on a given piece of art and explore cultural context of an artist's work.
Collaboration	Exercises that enhance group work, group discussion and collaborative thinking.

example, Bramstedt (2016), described a curriculum that involved mixed teaching methods including a workshop about VTS, mixed media art creations, painting, reflection in preselected painting, and art exhibit of students' art pieces. Demographics and programs description of the visual art training program are summarized in Table 1.

2. Program content. Six key competencies of focus were identified within these visual arts programs (Table 2).

While most schools' programs incorporated at least one aspect of the 6 competencies, the specific content varied. Twelve programs focused on knowledge and observational skills while employing various approaches to using visual art to deliver the sessions (Balemans et al. 2016; Bramstedt 2016; Kidd et al. 2016; Backhouse et al. 2017; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; Lyon et al. 2018; Cracolici et al. 2019;

Table 3. Evaluations of Art based medical education programs.

		Kirkpatrick evaluation levels			
Study	Mean of evaluation	1	2	3	4
Abidi et al. 2017	Post-course survey	Participants agree that films can be effective in medical education	Skill acquisitions and knowledge	Not indicated	Not indicated
Backhouse et al. 2017	Pre and Post anatomy tests, Likert-type scale questionnaire, Free-text questionnaire	Students did not feel they learned more than if they had done traditional sessions.	Anatomy knowledge	Not indicated	Not indicated
Balemans et al. 2016	Applied tests	Not indicated	Drawers had improved knowledge retention at one, four and six weeks post-intervention.	Not indicated	Not indicated
Bentwich and Gilbey 2017	Pre and post study vs control group	Contribution of VTS to the tolerance of ambiguity and visual observation are reported by the students to be substantially higher than the contribution to empathy.	Skill acquisitions and superior test scores	Not indicated	Not indicated
Bramstedt 2016	Online -question survey	Support the addition of arts in education	Skill acquisitions and reduction in burnout symptoms	Not indicated	Not indicated
Centeno et al. 2017	Pre-and post-course reflective exercise, standardised evaluation form, focus group	Rated highly by the students	Greater appreciation of the multifaceted nature of decision-making and need for individualized care	Not indicated	Not indicated
Cracolici et al. 2019	Pre and post survey, control group	Value curriculum endorse art as a valuable tool for learning medicine	Not Indicated	Not indicated	Not indicated
Godley et al. 2020	Post-course survey	Course quality rated highly by students (89% rated 'very good' or 'excellent')	Skill acquisitions (analysis, exposure, subjectivity, methodology, perspective-shifting)	Not indicated	Not indicated
Gowda et al. 2018	Pre- and post-program, validated survey instruments, focus group transcripts,	Value the skills acquisitions	Improved self-reflection scores and skills acquisition (observation, awareness of subjectivity, uncertainty)	Not indicated	Not indicated
Green 2015	Pre and post course survey	Support use of graphic narratives for skill acquisition	Skill acquisition	Transformed how students interact with patients	Improved the culture of the medical program
Grogan and Ferguson 2018	Pre and post qualitative survey, Focus group	Rated highly by the students	Skill acquisitions	Not indicated	Not indicated
Gurwin et al. 2017	Pre and post observation skills testing	Not indicated	Superior test scores	Not indicated	Not indicated
He et al. 2019	Open-ended questions	Value the skills acquisitions	Skill acquisitions	Not indicated	Not indicated
Jones et al. 2017	Post-course qualitative interview with open-ended questions	Not indicated	Skill acquisition	Not indicated	Not Indicated
Kidd et al. 2016	Pre and post qualitative survey, Focus group	Rated as valuable, relevant to medical practice	Skill acquisitions	Not indicated	Not indicated
Lyon et al. 2018	Focus group discussions	Not indicated	Not indicated	Not indicated	Not indicated
Maatman et al. 2020	Post-session feedback	Students endorsed a benefit from sessions	Not indicated	Not indicated	Not indicated
Masel et al. 2020	Post-session reflection	Format supported by students	Students able to critically reflect on clinical situations	Not indicated	Not indicated
Nash et al. 2021	Pre- and post-workshop survey	Content and format supported by most students	Skills and knowledge acquisition	Not indicated	Not indicated

(*continued*)

Table 3. Continued.

		Kirkpatrick evaluation levels			
Study	Mean of evaluation	1	2	3	4
Potash et al. 2016	Written reflection and post-activity group discussion.	Not indicated	Not indicated	Not indicated	Not indicated
Roberts and Noble 2015	Pre- and post-session surveys and dementia assessment scales	Not indicated	Improved attitudes towards dementia	Not indicated	Not indicated
Strohbehn et al. 2020	Pre and Post intervention surveys. Focus groups	Support use of course in training	Skills acquisition	Not indicated	Not indicated
Tsao and Yu 2016	Focus groups	Students supported us of comics to learn empathy	Knowledge and skills acquisition	Not indicated	Not Indicated

He et al. 2019; Masel et al. 2020). For example, the 'Art and Anatomy' elective included drawing sessions (on bones or one's own hands) and 3 D digital simulation enhances visual-perceptual ability to understand the body's interior (Grogan and Ferguson 2018). Eleven programs focused on empathy (Green 2015; Kidd et al. 2016; Tsao and Yu 2016; Centeno et al. 2017; Gurwin et al. 2017; Jones et al. 2017; Lyon et al. 2018; He et al. 2019; Godley et al. 2020; Masel et al. 2020; Strohbehn et al. 2020). Three programs addressed the tolerance to uncertainty through exercises that encourage students to share various perspectives on a given piece of art (Bentwich and Gilbey 2017; Gowda et al. 2018; Strohbehn et al. 2020). Three programs addressed cultural sensitivity (Kidd et al. 2016; Cracolici et al. 2019; Godley et al. 2020) and 13 programs addressed medical student wellness and resilience (Bramstedt 2016; Kidd et al. 2016; Potash et al. 2016; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Jones et al. 2017; Grogan and Ferguson 2018; He et al. 2019; Maatman et al. 2020; Masel et al. 2020; Strohbehn et al. 2020; Nash et al. 2021). For example, Potash et al. (2016) describe a program where students created mandalas in a process designed to facilitate self-reflection and their current psychological state. Additionally, team building was promoted in many programs (Green 2015; Kidd et al. 2016; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Jones et al. 2017; Lyon et al. 2018; Cracolici et al. 2019; He et al. 2019; Godley et al. 2020).

3. Program impact. Programs used various methods of assessing the impact of their courses, with some using multiple different methods. Evaluation methods included student surveys/feedback (Green 2015; Roberts and Noble 2015; Bramstedt 2016; Kidd et al. 2016; Abidi et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; Cracolici et al. 2019; He et al. 2019; Godley et al. 2020; Maatman et al. 2020; Masel et al. 2020; Strohbehn et al. 2020; Nash et al. 2021), focus groups (Potash et al. 2016; 2016; Tsao and Yu 2016; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Lyon et al. 2018; Cracolici et al. 2019; Strohbehn et al. 2020), pre-tests and/or post-tests (Kidd et al. 2016; Backhouse et al. 2017; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Lyon et al. 2018), 3 included a control group comparison (Bentwich and Gilbey 2017; Gowda et al. 2018; Cracolici et al. 2019), and post-course interviews (Backhouse et al. 2017; Jones et al. 2017). None of the studies included faculty or program assessment. The majority of articles evaluated their programs with respect to Kirkpatrick 1 (reaction) Kirkpatrick 2 (learning) (Table 2). Kirkpatrick 3 (behaviour) and 4 (results) were commented on by some, largely in a subjective and self-reported manner (Table 3). Kirkpatrick 1: most studies found that students valued learning various competencies through visual art, and agreed that visual art could be used in medical education (Green 2015; Bramstedt 2016; Kidd et al. 2016; Tsao and Yu 2016; Abidi et al. 2017; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; Cracolici et al. 2019; He et al. 2019; Maatman et al. 2020; Masel et al. 2020; Strohbehn et al. 2020). Kirkpatrick 2: learners demonstrated acquisition of a variety of skills and competencies specifically observational skills, empathy, knowledge and tolerance to uncertainty both qualitatively and quantitatively through scoring (Green 2015; Roberts and Noble 2015; Bramstedt 2016; Kidd et al. 2016; Tsao and Yu 2016; Abidi et al. 2017; Bentwich and Gilbey 2017; Centeno et al. 2017; Gurwin et al. 2017; Jones et al. 2017; Gowda et al. 2018; Grogan and Ferguson 2018; Cracolici et al. 2019; He et al. 2019; Godley et al. 2020; Strohbehn et al. 2020; Nash et al. 2021). Kirkpatrick 3: 3 programs reported a change in students' attitude toward uncertainty and ambiguity (Kidd et al. 2016; Gurwin et al. 2017; Gowda et al. 2018), depth in understanding the body (Grogan and Ferguson 2018) and suffering of others (Bentwich and Gilbey 2017). Some learners anticipated that the newly learned knowledge and skills would allow them to be more empathetic to patients in future practice (Tsao and Yu 2016; Cracolici et al. 2019). Kirkpatrick 4: results-based outcomes were largely qualitative reporting reduction in burnout symptoms (Bramstedt 2016), improvements in clinical knowledge and observational skills (Backhouse et al. 2017; Bentwich and Gilbey 2017; Gurwin et al. 2017; He et al. 2019; Masel et al. 2020), increased ability to recognize and report mistreatment (Nash et al. 2021), and empathy when serving patients and their families (Tsao and Yu 2016; Centeno et al. 2017; Jones et al. 2017).

Methodological quality of curricula

The mean total MERSQI score was 9 and ranged from 5 to 15 (see Table 4). Eight curricula (34%) demonstrated lower study quality with MERSQI scores $\leq$7. Four curricula (17%) had high scores $\geq$13.

Table 4. Methodological quality of 23 visual art curricula using the medical education research study quality instrument.

MERSQI domain	Study design	Sampling	Type of data	Validity of evaluation instrument	Data analysis	Outcomes	Total score (max 18)
Abidi et al. 2017, Pakistan	1.5	2	1	NA	1	2	7.5
Backhouse et al. 2017, UK	3	2	3	2	3	2	15
Balemans et al. 2016, US	3	2	3	2	3	2	15
Bentwich and Gilbey 2017, Israel	1	1.5	1	NA	3	2	8.5
Bramstedt 2016, Australia	1	1	1	NA	1	2	6
Centeno et al. 2017, Spain	2	2	1	NA	3	2	10
Cracolici et al. 2019, US	2	1	1	NA	1	1	6
Godley et al. 2020, US	3	1.5	1	NA	1	2	8.5
Gowda et al. 2018, US	1.5	1.5	3	3	3	2	14
Green 2015, US	1.5	2	1	NA	3	3	10.5
Grogan and Ferguson 2018, US	1	0.5	1	NA	1	2	5.5
Gurwin et al. 2017, US	3	1.5	3	3	1	2	13.5
He et al. 2019, US	1	0.5	1	NA	1	2	5.5
Jones et al. 2017, US	1	0.5	1	NA	1	2	5.5
Kidd et al. 2016, Canada	2	2	1	NA	1	2	8
Lyon et al. 2018, UK	1	2	1	NA	1	NA	5
Maatman et al. 2020, US	1	2	1	1	3	1	9
Masel et al. 2020, Austria	3	2	1	NA	1	2	9
Nash et al. 2021, Australia	1.5	2	1	NA	1	2	7.5
Potash et al. 2016, Honk Kong	1	0.5	1	NA	3	NA	5.5
Roberts and Noble 2015, US	1	2	1	NA	1	2	7
Strohbehn et al. 2020, US	2	1	3	3	3	2	14
Tsao and Yu 2016, Canada	1	2	1	2	1	2	9

Discussion

In this systematic review, we analyzed 23 studies that were published in the last five years. Several programs were offered as a university elective course and many were integrated within the existing curriculum. Previous studies have shown a direct benefit of integrated clinical components in art education training as compared to visual arts training alone (Frajerman et al. 2019). Further, integrating visual art-based programs into medical curriculum activities might be more feasible given the time constraints of medical school programs. A common program format involved a guided art observation, self-reflection exercises followed by a group discussion. This model was delivered in various settings such as museums, hospitals, and campus classrooms and is similar to the framework described by Haidet et al. Museum visits are guided by both clinician and museum educators, enabling students to recognize parallels between medicine's core skills and art observation (Williams and Zimmermann 2020). The utilization of existing expertise from art educators may help to bring clarity on arts-based interventions and ensure that appropriate evaluation methods are used (Naghshineh et al. 2008).

There is variability in the focus, content, and delivery amongst programs reviewed in this study. Depending on the duration of the program, some utilized different key components of visual art, and some utilized visual art from the lens of a specific competency. In general, the programs used visual art to enhance many skills such as clinical observation, empathy and wellness. Clinical observation, in particular, was identified as a key component of multiple programs. The enhancement of clinical observations from studying artwork has been described extensively in previous literature (Naghshineh et al. 2008; Larsen et al. 2017; Mukunda et al. 2019). This is an important skill as clinical diagnosis involves observation, description, and interpretation of visual information, which is a skill that can be generated and enhanced by examining works of art (Russell 2018). Visual art is also used to enhance empathy which is a core characteristic of successful clinicians (Schwartz et al. 2020). Most recent data showed a decrease in empathy among medical students and therefore visual art can be used as a tool to enhance this critical skill (Schwartz et al. 2020). Other reported skill developments that visual art training may improve are: tolerance to uncertainty, teamwork, communication skills, and sharing perspective as well as a tool to reduce student burnout and promote wellbeing (Kim and Lee 2018). However, while our results are consistent with previous studies, most of the above skills are evaluated based on anecdotal experience, and trends in some reports suggest a benefit (Mukunda et al. 2019).

Studies seldomly performed Kirkpatrick 3 and 4 outcome evaluation, making it difficult to infer which visual art teaching methods and training approaches should be prioritized in curricular design. Most of the evaluation assessments were limited to students' reactions and experiences and didn't explicitly assess all skills learned. Only a few programs adequately evaluated programs on behavior change and enduring results (Tsao and Yu 2016; Abidi et al. 2017; Gurwin et al. 2017; Grogan and Ferguson 2018). In general, observational skills were more easily assessed using objective measures. For example, Backhouse et al. and Balemans et al. used objective tests of anatomy and histology, respectively, to assess the impact of their drawing programs on student learning. However, the remaining five competencies were often assessed using student reflection, feedback forms, or Likert scale surveys. Only Gowda et al. implemented validated assessment tools to test for competencies such as tolerance for uncertainty, and empathy. More rigorous and evidence-based tools are needed to assess all skills, behaviours, and long-term outcomes. Without high-level outcome evaluation, it is difficult to infer which methods equip programs to generate a visual art curriculum, reflecting an opportunity for improvement in evaluative processes.

Today's medical students have an ever-expanding number of social media vehicles through which to express themselves. Based on analysis, none of the articles utilised social media platforms to promote or share visual learning by medical students. Social media platforms allow for faster

feedback by using interactive forums; holding group discussions and knowledge dissemination, (Cheston et al. 2013; Hillman and Sherbino 2015). One way to use social media in visual based education is displaying student work on an online gallery. There is evidence that online forums, galleries, and image sharing sites all give students chances to share ideas on specific themes and increase the speed of access to information, therefore enhancing learning efficiency and overall student's satisfaction (Pander et al. 2014). Although there is potential benefit in incorporating social networking sites into visual art-based courses, administrators have to balance their enthusiasm with the potential safety and liability issues that might arise including **breaching** student personal information as well as protecting student's artwork.

There are important barriers to consider when implementing visual art programs. First, with no evidence-based frameworks, it can be difficult to define and synthesize skills and competencies when implementing a visual art-based program. This was documented in our study demonstrating the variability of skills and focus prioritized and the teaching methods used. Second, administrative barriers exist, such as the cost of establishing a new course and the difficulties of integrating such a course into an existing full curriculum. Third, such programs require faculty who are competent and interested in leading such sessions. Lastly, some programs utilized a local museum and skilled artists which may not be present in other institutions.

Limitations

This systematic review has several limitations. The authors did not include unpublished articles, articles ahead of print, or not indexed at the time of the search. Additionally, those articles not available online were excluded. Given the paucity of articles explicitly focused on visual arts-based education, we chose to include papers that described humanism curriculum, however, only if they were indexed to visual arts in the database. Furthermore, 12 of the 23 studies were conducted in the US. Whether this reflects different curricular objectives, funding limitations, or another potential factor, the utility of our findings may not be applicable to programs found in geographic areas not represented by our study. Finally, it's possible that substantial portions of the teaching activities regarding this subject were not recorded in research, limiting comprehensive analysis.

Conclusions

The findings of this study indicate that visual arts can serve as a vehicle to address important competencies that are otherwise difficult to teach using the traditional methods. Clinical observation, in particular, had the strongest evidence of its effectiveness compared to the other competencies as objective pre- and post-tests were used to test students' knowledge prior to and following implementation of a visual arts program. Further, collaboration with a local museum enriches the experience for students. We propose using validated scales to measure outcomes in future studies. For example, validated scales to measure competency development, such as the Groningen Reflection Ability Scale or the Tolerance for Ambiguity Scale, can provide more objective skill development assessments. Future programs incorporating visual arts will benefit from a longitudinal (greater than 6 weeks) program which incorporates guided artworks, reflection exercises, and a group discussion to provide a stronger foundation for the development of core competencies. Furthermore, follow-up with program participants will allow for evaluation of Kirkpatrick Level 3 and 4 outcomes, namely sustained behavioural changes gained from the program. Finally, incorporating social media platforms within the visual art courses may allow for faster feedback by using interactive forums; holding group discussions and knowledge dissemination.

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