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Art, Anatomy, and Medicine: Is There a Place for Art in Medical Education?

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For many years art, anatomy and medicine have shared a close relationship, as demonstrated by Leonardo da Vinci's anatomical drawings and Andreas Vesalius' groundbreaking illustrated anatomical textbook from the 16th century. However, in the modern day, can art truly play an important role in medical education? Studies have suggested that art can be utilized to teach observational skills in medical students, a skill that is integral to patient examination but seldom taught directly within medical curricula. This article is a subjective survey that evaluates a student selected component (SSC) that explored the uses of art in medicine and investigates student perception on the relationship between the two. It also investigates whether these medical students believe that art can play a role in medical education, and more specifically whether analyzing art can play a role in developing observational skills in clinicians. An "Art in Medicine" 8-week course was delivered to first year medical students at Brighton and Sussex Medical School. The use of art to improve observational skills was a core theme throughout. Feedback from the students suggests that they believe a strong association between art and medicine exists. It also showed a strong perception that art could play a role in medical education, and more specifically through analyzing art to positively develop clinical observational skills. The results of this subjective study, together with those from research from elsewhere, suggest that an art-based approach to teaching observational skills may be worth serious consideration for inclusion in medical and other healthcare curricula. Anat Sci Educ 7: 370–378. © 2014 American Association of Anatomists.

Key words: medical education; gross anatomy education; art; fine arts; observational skills; anatomy; student selected component; student enrichment programs

INTRODUCTION

The link between art, anatomy, and medicine has been well established for hundreds of years. During the 16th century, Leonardo da Vinci (1452–1519) produced a dossier of anatomical drawings, which are still admired today for their anatomical accuracy and intricate drawing technique. Soon after, in 1543, Andreas Vesalius (1514–1564) published his groundbreaking and beautifully illustrated anatomy textbook, named *De Humani Corporis Fabrica Libri Septum* (Lasky, 1990; Calkins et al., 1999; Porzionato et al., 2012). Trained artists, thought to be pupils of Titian (1488/90–1576)—an Italian Renaissance painter of the Venetian school, were hired to produce these illustrations that depicted internal human anatomy (Geranmayeh and Ashkan, 2008; Perloff, 2013). These two examples represent a universally well-known association between art and anatomy. Clinicians have studied these great manuscripts for many years, which have allowed for improvements in their anatomical knowledge base and clinical practice (Benini and Bonar, 1996; Geranmayeh and Ashkan, 2008; Shoja et al., 2013).

In recent years, alternative uses of art within medical education have been explored. The use of art in improving observational skills in clinical practice is one that has been investigated by numerous studies (Bardes et al., 2001; Dolev et al., 2001; Elder et al., 2006; Shapiro et al., 2006; Kirklin

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et al., 2007; Naghshineh et al., 2008; Schaff et al., 2011; Jacques et al., 2012; Friedlaender and Friedlaender, 2013). However, other applications that have been investigated include the use of art to gain a greater understanding of disease, as well as the patient's perspective of it, and a greater ability to empathize (Darbyshire, 1996; Kirklin et al., 2000; Lazarus and Rosslyn, 2003; Blomqvist et al., 2007; Geranmayeh and Ashkan, 2008; Kumagai, 2012). For example, through the art of Mexican painter Frida Kahlo (1907–1954), it is believed that one can gain a greater understanding of suffering and disability (Darbyshire, 1996). The use of comics ("graphic pathographies") in medical education has also been investigated with suggestions that it may aid in learning anatomy, fostering empathy, improving observational skills and developing diagnostic reasoning skills (Green and Myers, 2010; Park et al., 2011; Czerwiec, 2013).

For many years, medical schools around the world have focused heavily on teaching their students to appropriately examine patients, with the aim of producing clinicians with adequate diagnostic abilities. Observation of clinical signs plays a significant role within these examination skills. For example, the General Medical Council (GMC) in the United Kingdom (UK), which governs the content and objectives that medical schools teach in the UK, requires graduates to be able to make accurate observations of clinical phenomena (GMC, 2009). In medicine, there are many visual clues to be gained, some of which carry great significance. Performing an unbiased physical examination is an essential part of patient assessment, and for an accurate clinical diagnosis a clinician needs to be able to observe, describe and interpret visual information accurately (Anderson et al., 2001; Bardes et al., 2001; Naghshineh et al., 2008). However, despite the importance of observational skills in clinical practice, there is a tendency for this skill to be overlooked at medical schools in terms of having a place in the curriculum (Dolev et al., 2001). Medical students typically learn the abnormal signs of pathology, but it seems that the actual skill of "looking" and interpreting is seldom taught within medical curricula (Bardes et al., 2001; Dolev et al., 2001).

In recent years, evidence has shown that the examination skills of medical students and clinicians have deteriorated (Mangione and Peitzman, 1996; Wenrich et al., 2011; Oliver et al., 2013). This is, in part, attributed to a greater reliance on improving imaging technologies and other investigation modalities to diagnose patients, (Dunnington et al., 1992; Macdessi and Oates, 1993; Bordage, 1995; Mangione and Peitzman, 1996; Tavel, 1996; Anderson et al., 2001; Fagan et al., 2003). Although these advancements are often critical to improving patient care, the number of unnecessary investigations performed on patients has increased, a lot of which could have been avoided by simple examination (Macdessi and Oates, 1993; Bordage, 1995). This results in greater cost to the medical service and a loss of clinical skills (Smith-Bindman et al., 2008). In more recent years, medical schools have therefore given greater emphasis to the teaching of clinical examination skills (Martineau et al., 2013).

The integration of "Visual Literacy" in medical education has been investigated by numerous studies to show whether or not an art-based teaching approach has the ability to aid in the learning of physical examination skills. Visual Literacy is the "ability to reason physiology and pathophysiology from visual clues" (Bardes et al., 2001; Dolev et al., 2001; Elder et al., 2006; Shapiro et al., 2006; Kirklin et al., 2007; Naghshineh et al., 2008; Schaff et al., 2011; Jacques et al., 2012; Friedlaender and Friedlaender, 2013). Many of these studies have used an art-based technique, whereby artwork is observed, described, and the findings interpreted and discussed within a group. The results of these studies have been promising. They have demonstrated improved observations of patient characteristics, which have led to the clinician's greater ability to diagnose and problem-solve, understand the human effects of disease, and embrace multiple perspectives (Bardes et al., 2001; Dolev et al., 2001; Shapiro et al., 2006; Naghshineh et al., 2008; Schaff et al., 2011; Jacques et al., 2012). For example, Naghshineh et al. (2008) performed a blind study that compared with a control group the observational skills of medical students at Harvard Medical and Dental School who were involved in a nine session course called "training the eye: improving the art of physical diagnosis," which was run by both art educators and physicians. The course consisted of art observation exercises, which were supplemented with didactic teaching that integrated these skills with clinical medical work. Art observation exercises involved students inspecting, describing, interpreting, and discussing existing artwork. Students were also asked to complete homework, which included reading and visual training exercises. Pre- and post-course tests were performed comparing this intervention group with an inert control group's ability to write descriptions of physical findings of slides of patients with clinical disorders and generic artwork. The study concluded that this course significantly improved the medical students' ability to make more frequent and accurate observations of physical findings. Similar courses have also been delivered within nursing education, with similar results (Pellico et al., 2009; Frei et al., 2010).

At Brighton and Sussex Medical School (BSMS) in the UK, medical students learn anatomy primarily through dissection (Evans and Watt, 2005). Learning anatomy in this manner requires the student to observe physical structures in relation to those around it as well as developing effective dexterous and interpretation skills (McLachlan, 2004; McLachlan and Patten, 2006; Rizzolo and Stewart, 2006). The ability to observe in anatomy can be assessed to a degree through formative and summative assessment, but is not necessarily a skill that is taught. A student selected component (SSC) was therefore developed and delivered in collaboration with the Anatomy Department to explore the uses of art within medicine and how art might aid observational skills development. The use of art to improve observational skills was a core theme that was implemented throughout the SSC.

This article is a subjective survey that evaluates this Art in Medicine SSC and investigates student perception on the strength of association between art and medicine. This study also investigates whether medical students enrolled on this Art in Medicine SSC believe that art can play a role in medical education, and more specifically whether analyzing art can play a role in the development of observational skills in clinicians.

METHODS

Definition of "Observational Skills"

Many studies have used the term "observational skills" and although they allude to the meaning of this term, no study has explicitly defined it. Taking into account the content of these studies (Bardes et al., 2001; Dolev et al., 2001; Shapiro et al., 2006; Naghshineh et al., 2008; Jacques et al., 2012), a definition for the term was formulated for the purpose of this study. We have therefore defined it as "a person's ability to

identify physical characteristics. This includes pattern recognition, which focuses on identifying the familiar, but also includes the ability to identify the unfamiliar."

Student Selected Components

Student selected components (SSCs) are an integral part of the medical curriculum within the UK. The GMC states that the purpose of an SSC "is the intellectual development of students through exploring in depth a subject of their choice" (GMC, 2009). During the first and second years of student training at Brighton and Sussex Medical School (BSMS), SSCs are offered as short courses within each systems-based module.

Student Allocation

Students were given a list of 12 SSCs to choose from and submitted their requests in order of preference. The medical school office was responsible for allocating the students to a specific SSC taking into account the students' preferences. All SSCs were delivered concurrently.

Ethical Approval

Before commencement, this study was reviewed by the Joint-Chairs of the Brighton and Sussex Medical School ethics committee and was deemed exempt from further consideration and allowed to proceed.

"Art in Medicine" SSC Design and Development

The "Art in Medicine" SSC was delivered to first year medical students, alongside their second term module called "heart, lungs, and blood." It consisted of eight sessions over 8 weeks. Each session lasted between 1 and 2 hr, with the last two sessions allocated for student assessment. Each of the first five sessions were split into two parts, the first of which was an orally presented interactive tutorial incorporating visual elements (i.e., images of pre-existing paintings and photographs on screen), using a Microsoft PowerPoint presentation as a facilitating guide. Group discussions and brainstorming periods facilitated by one of the course tutors were incorporated into this to maintain an interactive value to the tutorials. An example of a topic for the brainstorming sessions included "how can art be of use in medicine?". The second part of each session was a practical session that encouraged the students to produce their own artwork using drawing materials provided by the anatomy department. This commonly took place in the dissection room using cadaveric specimens as models. The practical sessions were an exercise designed to improve observational skills, as we believed that through the observation required to draw models students were subconsciously forced to pick out details that they would not otherwise have noticed. This is a notion that is shared by Moore et al. (2011). Each of these five sessions was focused on a topic relating to their module that term in order to maintain continuity in their learning. The sixth session was a life-class drawing session, which was run in collaboration with members of the anatomy department of BSMS and a local artist.

Using skills gained through art to improve clinical observations was a core theme that was incorporated throughout the SSC. Students were reminded of this multiple times and the course incorporated a number of opportunities for this to be put into practice. During the interactive tutorials, students were invited to analyze images on projected PowerPoint slides of existing paintings of established artists (e.g. "Standing by the Rags" painted by Lucian Freud in 1988–1989 and "Judith Beheading Holofernes" painted by Amerighi da Caravaggio in 1598–1599). Students picked specific observations and used this to explain the circumstance of the scene within the painting. During the practical sessions, as the students drew cadaveric specimens, they were encouraged to think of the layered anatomy beneath to not only help with the accuracy of their drawing, but also to help understand the reasoning behind the shapes they could see. The life-class drawing session was also an opportunity to emphasize this theme. Students were encouraged to think about why their observations appear as they do. This self-reflective thought process was purposeful in design with the intention that the students would take this skill into clinical practice when observing patients.

In between sessions, student-directed learning as a pre-call activity was encouraged to prepare for following sessions. Before each weekly session the students were told the topic for the following week. For some sessions they were notified of a topic for group discussion (e.g., what can blood signify in art?). They were encouraged to do research in their own time using these topics, enabling them to contribute in the subsequent sessions.

Student Assessment

Student assessment took place during the final two sessions. Each student was required to present orally for 10 min on a topic that they found interesting relating art to medicine. A portfolio of their own artwork relating to their topic of choice supported the presentation. Students were encouraged to incorporate their artwork into their presentation to aid in the delivery of the messages that they wished to convey. Emphasis was given to the students that the quality of the presentation and its delivered content was important, rather than their technical artistic ability. Student participation throughout the 8 weeks was also taken into account.

The presentations were assessed by three tutors to reduce bias, two of whom were involved in the delivery of the SSC. The presentations were assessed in accordance to the BSMS "SSC guidelines for presentation markers," which are guidelines followed by all SSCs, and so not specific to this course. Students were therefore assessed on: the identification and use of sources for researching information for their presentation; the student's understanding of the presentation topic; their presentation skills; whether the presentation delivery was appropriate to their audience; their use of PowerPoint (including appearance, layout of slides, organization of material and use of English); and their attitude and engagement within the SSC. Summative assessment marks (Pass or Fail), as well as formative feedback, was provided using the Brighton and Sussex Medical School (BSMS) "assessment report forms." Distinctions were also awarded if there performance throughout the SSC was thought to be exceptional in all these areas.

Student Evaluation/Feedback

At the end of the SSC, students completed a questionnaire evaluating the SSC and focus was given to whether art can

play a role in teaching observation skills. No precourse questionnaire was used. Anonymity was preserved to encourage unbiased reviews. The questionnaire was designed by one of the tutors (L.B.) and incorporated a mixture of questions for which the student circled the answer that they found most appropriate and open-answer questions encouraging student-generated thoughts. An example of a closed-answer question that was used includes "do you think art can play an important role in the education of medical students?," for which they circled either strongly agree, agree, indifferent, disagree, or strongly disagree. An example of an open-answer question that was used is "what are the most important things that you felt you learned during the course?"

Students were also obliged to complete the formal electronic questionnaire generated centrally by the medical school for each module. This used a four-point Likert scale approach for some questions and open-ended answers for others. Some questions on this questionnaire were directed at the SSC undertaken by students during that module and results were made available to the tutors after analysis. The students were asked to provide a score (1 = very poor, 2 = poor, 3 = quite good, 4 = very good) on a four-point Likert scale for the overall quality of the delivery of the SSC, which is an example of a question within this questionnaire.

Statistical Analysis

Microsoft Excel program (Microsoft, Redmond, WA) was used to analyze the data. Differences between student perceptions regarding the link between art and medicine pre- and post-course were compared using chi-squared and *t* tests.

RESULTS

Student Demographics and Allocation

A total of 12 different SSCs were offered to the students, of which 12 students were allocated to this SSC. The average number of students per year at BSMS is 135. Nine students were female (75%) and the rest male (25%). Eight students (67%) had ranked this SSC as their first or second choice.

Previous art experience varied within the group, with seven students (58%) having pursued art at secondary school and one (8%) to degree level. The rest (33%) had suggested that they had no experience in studying art.

Student Evaluation/Feedback

There was a 92% and 100% completion rate for the centrally generated generic questionnaire and the SSC specific questionnaire respectively. Centrally generated generic feedback revealed that this SSC was very well received by students. As shown in Figure 1, the SSC was the highest rated for all four aspects within the module compared to other SSCs. For the overall quality of the delivery, the usefulness of the material and the enjoyability of the material the SSC achieved the highest mean scores (4.00, SD ±0.00; 3.82, SD ±0.40; and 4.00, SD ±0.00 respectively), and this was despite being perceived as the SSC with the highest difficulty of material (3.64, SD ±0.67). Specific comments from this centrally generated feedback included "I enjoyed the alternative perspective of my SSC" and "art in medicine SSC was awesome, it allowed me to relax and explore another angle of medicine."

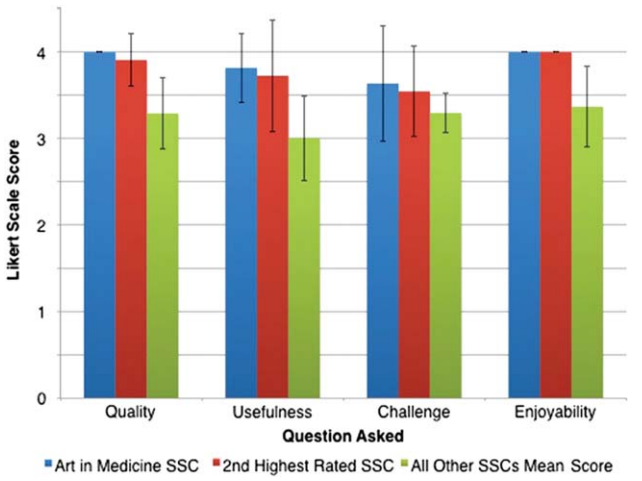

Figure 1.

All students were asked to fill in centrally generated formal questionnaires at the end of the module. Within this questionnaire students were requested to provide a score on a 4-Point Likert Scale (1 = highly negative, 4 = highly positive) to four specified aspects of the SSCs (quality, overall quality of the delivery of the material; usefulness, the usefulness of the material; challenge, the difficulty/challenge of the material; enjoyability, the interest/enjoyability of the material). The above chart demonstrates the mean scores and standard deviations for various SSCs. $n = 11$ respondants for Art in Medicine SSC (response rate 92%).

Within the SSC specific questionnaire, students were asked to grade their perceptions on the strength of the link between Art and Medicine before and after the SSC. Figure 2 shows the results of this and demonstrates that students felt that there was a stronger link between the two after the SSC. For this data, ideally we would like to perform a chi-squared test for categorical data (Null hypothesis: This course did not change student perception). However as we can see from Figure 2, no one thought the link was average, weak or very weak after the course. Therefore, the only way that we can perform a chi-squared test would be to amalgamate the very weak to strong responses, which would mask much of the impact. This gives a *P* value of 0.85, thereby accepting the null hypothesis of no significant impact. However, Figure 2 clearly demonstrates a shift towards a positive link between art and medicine. If the scores are treated as continuous data and assumptions of normality are made, a paired value *t* test gives a *P* value of 0.0001, thereby rejecting the null hypothesis.

Students were also requested to grade their thoughts on a number of issues relating art to medicine within medical education. Figure 3 shows the mean scores and standard deviations for these questions. For the purpose of this analysis, student responses were converted to a Likert Scale Score (1 = strongly disagree, 2 = disagree, 3 = indifferent, 4 = agree, 5 = strongly agree). The results revealed a mean score of 4.75, SD ±0.61 for the question "Do you think art can play a role in the education of medical students?"; 4.33, SD±0.49 for the question "Do you feel skills used through art can be beneficial in your future practice as a doctor?"; 4.58, SD ± 0.51 for the question "Do you feel art can play a role in

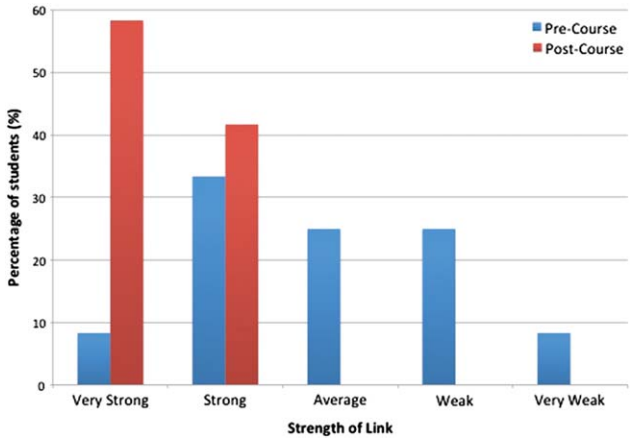

Figure 2.

All students were asked to fill in an SSC specific questionnaire at the end of the 8-week period. Within this questionnaire students were requested to grade on a scale (very strong to very weak) the questions "prior to the course, how strong did you feel the link between art and medicine was?" and "after the course, how strong did you feel the link between art and medicine was?". $n = 12$ respondants for Art in Medicine SSC (response rate 100%).

improving observational and diagnostic skills in clinical practice?"; 4.67, SD ±0.49 for the question "Do you feel similar courses to this would be beneficial to other members of your year?"; and 4.17, SD ±1.11 for the question "Do you feel teaching of observational skills specifically through art analysis should be incorporated into your medical course?"

The open-ended answers provided in this questionnaire reflected much of the statistical feedback. Many students

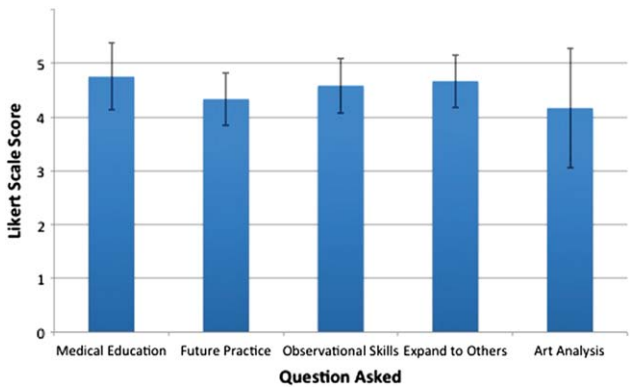

Figure 3.

Within the SSC specific questionnaire students were requested to grade on a 5-Point Likert Scale (1 = strongly disagree to 5 = strongly agree) their thoughts on a number of issues relating art to medical education (Medical education, do you think art can play a role in the education of medical students?; Future practice, do you feel skills used through art can be beneficial in your future practice as a doctor?; Observational skills, do you feel art can play a role in improving observational and diagnostic skills in clinical practice?; Expand to others, do you feel similar courses to this would be beneficial to other members of your year?; Art analysis, do you feel teaching of observational skills specifically through art analysis should be incorporated into your medical course?). The above chart demonstrates the mean scores and standard deviations. $n = 12$ respondants for Art in Medicine SSC (response rate 100%).

Figure 4.

Drawing of prosected thorax by Maria Hill Rabasa (Year 1 Medical Student, 2012).

cited the benefits in respect to observational skills that art skills can contribute to, as one of the most important things that they had learnt during the SSC. A few students had stated that this was very useful specifically in relation to learning anatomy. When asked about the most important aspects that they feel art can contribute to medical education, specific comments made by students included "improve understanding and enhance learning of anatomy," "observational skills, which helped me with my anatomy revision," and "observation, creativity, and a better imagination—really useful for picturing anatomy." Figures 4 and 5 are examples of artwork produced by students within the anatomy laboratory. These pieces demonstrate a high degree of anatomical understanding through their anatomical accuracy. Some students also felt that, from a clinical point of view, it helped to improve their understanding of diseases and the impact of these diseases from a patient's point of view. Comments made by students that demonstrate this included "it lets us see disease and its impact from a patients point of view" and "one's eyes are opened to the possibility that art can be seen anywhere and can help learning and understanding of disease."

SSC Student Assessment

One student had chosen "learning to look—developing clinical observational skills by using fine art" as the subject for their presentation, for which the student researched existing programs that aimed to do this and ultimately explained that they were favorable towards the use of art in improving clinical observational skills. Another three students also mentioned this topic as an important learning point during their presentations. This helps to demonstrate that the students found art to be a useful means by which observational skills can be improved. Other topics for presentations included "art and mental health," "deformity and plastic surgery," and "styles and applications of art in medicine."

The students seemed generally enthusiastic throughout. The quality of presentations and portfolios was generally very high, with three students (25%) achieving distinctions as

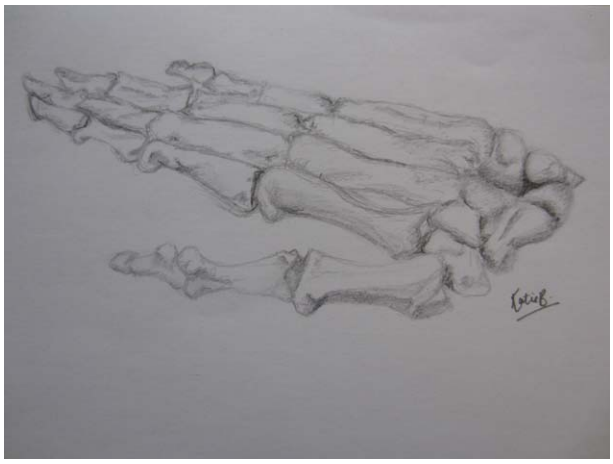

Figure 5.

Drawing of skeleton of hand by Katie Boughen (Year 1 Medical Student, 2012).

overall grades. Distinctions were awarded for exceptional performance. These students showed an enthusiastic attitude and made significant contributions to all activities. They also gave well-structured and clear presentations, integrating their own artwork in aiding the progression of their presentation. Figures 6 and 7 are examples of artwork used in this manner. Figure 6 shows an oil pastel drawing, which was copied from a piece of work by a contemporary British painter Jenny Saville that depicted herself in a distorted way to evoke the emotion of disgust. This was used in a presentation looking at realism and expressionism, and how both of these forms of art can be utilized in medicine. Figure 7 shows an oil pastel drawing, which was used in a presentation that explored what blood could signify in art. This specific piece shows blood signifying the strong bonds between family members.

All students used Microsoft PowerPoint as the mode of delivery for their presentations, in addition to their accompanying portfolios of artwork. The students in the audience demonstrated a high level of interest in the presentations, with intelligent questions being asked at the end, which allowed the topics of presentation to be expanded upon.

DISCUSSION

The incorporation of the arts in medicine is becoming more popular (Lazarus and Rosslyn, 2003; Kumagai, 2012). This has led to an increasing amount of research within this area (Lazarus and Rosslyn, 2003). Studies have suggested that the analysis of literature and dramatic arts has the potential to improve understanding of disease and illness, as well as the patient's perspective of it (Lancaster et al., 2002; Shapiro and Hunt, 2003; Jacobson et al., 2004). However, it is the use of the visual arts within medical education that seems to have received the greatest attention. Studies have suggested that involvement in art production and the analysis of existing art has the potential to improve observational skills, understanding of disease, understanding of patient's perspective of disease, fostering empathy, diagnostic skills and appreciation of multiple perspectives (Darbyshire, 1996; Kirklin et al., 2000; Bardes

Figure 6.

Oil pastel drawing by Katie Boughen (Year 1 Medical Student, 2012).

et al., 2001; Dolev et al., 2001; Lazarus and Rosslyn, 2003; Elder et al., 2006; Shapiro et al., 2006; Blomqvist et al., 2007; Kirklin et al., 2007; Geranmayeh and Ashkan, 2008; Naghshineh et al., 2008; Green and Myers, 2010; Park et al., 2011; Schaff et al., 2011; Jacques et al., 2012; Kumagai, 2012; Czerwiec, 2013; Friedlaender and Friedlaender, 2013).

The results of this subjective survey suggest that the students were very enthusiastic towards an SSC that explored

Figure 7.

Oil pastel drawing by Shahnaz Ali (Year 1 Medical Student, 2012).

the use of art within medicine. The favorable scores that this SSC received through the centrally generated generic questionnaire and the open-ended answers provided through the SSC specific questionnaire emphasize this. Schaff et al. (2011) also showed that students were enthusiastic towards a student-selected course that linked art and medicine. In their study, their course was also the most highly rated compared to other more traditional topics. This further reinforces student support for courses like this. Our survey showed a likely positive shift in student opinion regarding the strength of association between art and medicine prior to and following this course as well. It seems clear that the students enrolled in this course believed that there was at least a strong association between art and medicine after the course.

The study also suggests that students enrolled on this art in medicine SSC were supportive of the idea of incorporating art into medical education and they felt that through the analysis of art, improvements in observational skills could be gained. This reflects the conclusions of the numerous studies investigating the effect of analyzing artwork on the development of observational skills (Bardes et al., 2001; Dolev et al., 2001; Elder et al., 2006; Shapiro et al., 2006; Kirklin et al., 2007; Naghshineh et al., 2008; Schaff et al., 2011). These studies can be divided into those that collated qualitative data (Elder et al., 2006; Shapiro et al., 2006; Schaff et al., 2011) and those that collated quantitative data (Bardes et al., 2001; Dolev et al., 2001; Kirklin et al., 2007; Naghshineh et al., 2008).

Of the studies that collated quantitative data, Bardes et al. (2001) delivered a course that incorporated tutorials and exercises in the analysis of art through a collaboration between Weill Cornell Medical College and members of The Frick Collection (a private art museum in New York, NY). The students performed a test prior to and following the course, which involved written descriptions of observations made from photographs of patients' faces. The results demonstrated better scores after the course. However, this study lacked a control group, and so it is difficult to conclude whether the improvements were as a direct consequence of analyzing fine art (Perry et al., 2011). Naghshineh et al. (2008), on the other hand, did compare against an "inert" control group. Prior to and following the course a similar test for observations was performed using slides of artwork and photographs of patients. The results revealed a significantly improved ability to make frequent and accurate observations of physical findings. Unfortunately, a description of the control group is lacking in this study.

Dolev et al. (2001) and Kirklin et al. (2007) also performed quantitative studies, but compared the art analysis intervention with an alternative intervention. Dolev et al. (2001) performed a study on students at Yale University School of Medicine. This included an intervention group, who took part in an art analysis course, as well as a lecture group involved in lectures of radiographic images, and a control group involved in standard clinical tutorials. Students enrolled in this study, once again, took part in an observations test prior to and following the course involving photographs of patients with medical disorders. Interestingly, this study showed significantly higher post-course test scores within the intervention group, compared to the lecture and control groups. These results have been mimicked by Kirklin et al. (2007), who compared an intervention group involved in arts-based observational skills training, with a control group involved in lectures and practical sessions on the management of dermatological conditions. Following pre- and post-course observation tests involving descriptions of photographs of dermatological conditions, significantly higher post-course test scores were found in the intervention group. These results are enlightening, as not only do they support the use of art analysis in teaching observational skills within clinical practice, but it also demonstrates that this method may be superior to teaching methods that are currently in use within medical schools. However, the alternative interventions used within these studies are by no means exhaustive and there was no mention of any evidence base on which alternative interventions were chosen. Therefore, the alternative interventions may not have been directed towards or appropriate for improving observational skills.

In addition to the quantitative studies, there have also been numerous qualitative studies. Elder et al. (2006) and Schaff et al. (2011) delivered courses that incorporated tutorials and exercises in the analysis of art. Following both of these courses, the students were asked to complete questionnaires, the results of which were favorable towards an art-based approach to teaching observational skills. This is certainly in keeping with the opinions of students within this study. However, Shapiro et al. (2006) has performed the most comprehensive qualitative study, which was held at the University of California. Students within this study were enrolled into either a group with clinically-based sessions delivered by the School of Medicine or a group involved in arts based sessions delivered by the School of Arts. It was stated that both interventions were aimed at refining observational and pattern recognition skills. Qualitative data was collated from interview comments, written student feedback, participant observations from tutors and tutor debriefings. Triangulation of the data received from these sources concluded that observational and pattern recognition skills were thought to have improved in both groups, but a greater appreciation of pattern recognition was found in the clinically-based group. However, a greater appreciation of "emotional recognition, cultivation of empathy, identification of story and narrative, and awareness of multiple perspectives" was found within the arts-based group (Shapiro et al., 2006). These results are interesting, as it suggests that a clinically-based intervention may be as effective, if not better, as an art-based intervention in the teaching of observational skills. However, it would be difficult to conclude this without quantitative data to support it. It must also be noted that this study also found additional advantages of the art-based intervention.

Within this SSC, the open-ended feedback answers also raised an interesting topic. Some students believed that using anatomical models for the production of art as a method of teaching observational skills in a practical context was helpful. This is not surprising considering that there are many interchangeable skills. Anatomy is a very visual topic that utilizes the skill of observation, especially in an environment in which dissection is used as a method of teaching. Students were particularly supportive of the incorporation of an anatomical aspect, as some felt that it gave them a greater appreciation and understanding of the three-dimensional spatial relations of anatomy. As a result, some felt that their knowledge of anatomy had improved. This is a notion that is shared by Moore et al. (2011), which describes an Art and Anatomy course performed at Texas Health Science Center at San Antonio to encourage the development of observational skills and the comprehension of anatomy. However, this study stops short of investigating its actual effectiveness. In

future studies, it would be interesting to quantitatively investigate, through the use of a randomized controlled trial, whether the production of artwork of anatomical models has the potential to improve students' understanding of anatomy. This is not currently possible at this particular medical school due to a lack of available time in the course for students, teachers and the anatomy laboratory to deliver this.

On the whole, the evidence suggests that an art-based approach could benefit the teaching of observational skills. The opinions of the students enrolled within this study also reflect this. Nonetheless, we must also be aware of some generic limitations to the previous studies, which could also apply to this one. The majority of the studies were performed on self-selecting populations, with the participants themselves choosing to be a part of an "arts" course. It is therefore likely that these participants would be more receptive towards an art-based intervention. As an SSC is by nature something that is "student-selected," it introduces a degree of bias. The selection procedure for this SSC is most likely to have attracted people with an artistic predisposition, and so this may have resulted in a group of students who were more likely to be favorable towards the incorporation of art in medical education. Other students may not have been as receptive. Future studies should move away from these self-selected populations and utilize randomized populations of medical students and clinicians for a more representative analysis. Unfortunately, this is not possible within an SSC setting, as the student will always have a choice. In general, removing this bias may prove to be challenging, as it could be difficult to persuade students and medical course organizers to partake in something that seems detached from current culture within medical education. On the other hand, actively selecting those with artistic predispositions may be a desired outcome in some circumstances, as it would allow those that are most likely to benefit from this method to be identified. However, this would only be ideal if there were other methods available for people with other predispositions that are just as effective at improving observational skills. If that were to be the case, then an SSC may be the most appropriate delivery method.

There is also a lack of existing studies that compare the art analysis intervention with other interventions. Dolev et al. (2001), Shapiro et al. (2006), and Kirklin et al. (2007) are a few studies that have done this. More studies that do this would help establish whether this method is superior. Ideally, this would include alternative interventions that have been shown to have a positive effect on observational skills. Considering the results of Shapiro et al. (2006), an alternative intervention similar to that used within this study may be appropriate.

It is interesting to note that all the tests performed within the quantitative studies used photographs (Bardes et al., 2001; Dolev et al., 2001; Kirklin et al., 2007; Naghshineh et al., 2008). Future studies may want to consider the use of actual patients in real-life scenarios. This would further strengthen the existing evidence, and increases its relevance to clinical practice. It would, however, be difficult to do this, as there would be ethical considerations, as well as it being time intensive and resource heavy.

Limitations

More specific to this study, the small sample size could be viewed as a limitation. Despite this, the paired *t* test suggests a highly significant shift to supporting a strong association between art and medicine in students participating in this SSC. However, it must be noted that a chi-squared test would have been more appropriate, but the data that was collated did not allow for reasonable analysis in this manner and this was, in part, due to the small sample size, which a larger sample size could have helped. The study is also lacking a precourse questionnaire. Precourse data was therefore collated following the delivery of the course. This may not be wholly representative of the students' thoughts prior to the course, as it involves their ability to think back to the start. Any future studies should ensure a pre-course questionnaire to eliminate this bias.

CONCLUSION

The students enrolled in this art in medicine SSC believed that there exists a strong association between art and medicine. It also demonstrated a strong perception that art could play a role in medical education, and more specifically through analyzing art to positively develop clinical observational skills. In addition to this, there is strong evidence from previous studies to support an art-based method as a novel and effective way to allow medical students to develop their observational skills. Research in this area is still at an early stage and it seems that debates on this topic are unlikely to demonstrate a general consensus for one specific method of teaching this skill.

Future studies should concentrate on quantitative research with truly randomized samples from populations comprising of medical students and professionals. It is also important to compare the use of art methods with other evidence-based methods for improving observational skills. Additionally, a study to investigate whether the production of artwork in an anatomy setting has the potential to benefit the student's deeper understanding of anatomy would be interesting. Lastly, the importance of an enthusiastic and knowledgeable tutor with courses of this type must not be underestimated and may have a bearing on the course's success. Nevertheless, it seems that art has the exciting potential to fill an important deficiency in medical curricula in terms of developing observational skills.

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