Illustrating the art of (teaching) medicine

Carol Ann Courneya1*

Abstract: This essay chronicles the multi-year evolution of an art-making project involving first-year medical and dental students. It started as a call for artistic interpretations, through photography, of the cardiac science that the students were learning in their curriculum. On the basis of their initial enthusiasm for the project, and in response to subsequent student's requests, it broadened to include a wide variety of media (photographs, paintings, sketches, sculptures, installations, and videos), but always related to the original cardiac theme. Beyond just "pretty pictures" many of these images were student interpretations of foundational anatomy, physiology, and pathophysiology. Many required a sophisticated understanding of the structure or function in order to translate the science into art. Some students used clever metaphors and fanciful thinking to create their art. Dental students showed a preference for creating art that required manual dexterity and hand–eye coordination. Completing the circle, this multi-year repository of student-generated cardiac art has been used as vital learning objects in on-going medical school lectures, as an alternative representation of anatomy and physiology. The significance of using art-making as a learning tool in medical/dental training is discussed in this essay.

Subjects: Visual Arts; Medicine; Dentistry

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1. How it started
How to Use Photography to Stimulate Critical Thinking! Now there was a workshop title that got my attention. Dr. Chris Eleseer's workshop was offered at a Society of Teaching and Learning in Higher

ABOUT THE AUTHOR
Carol Ann Courneya is the assistant dean of Student Affairs and an associate professor in the Faculty of Medicine at the University of British Columbia in Vancouver, Canada. She has a multi-decade history of teaching cardiac science to medical and dental students and has consistently incorporated student art-making opportunities into her teaching. Her research interests have included admissions strategies, curriculum design, and most recently the role for arts and humanities in medical education.

PUBLIC INTEREST STATEMENT
When you think of your doctor, how often do you think about his life outside of medicine, or whether that lovely oil painting on her office wall was in fact painted by her? Medical students are selected, at least in part, due to their extra-curricular interests, some of which are artistic in nature. This essay chronicles a multi-year project where medical students were invited to conceptualize artistically what they were learning about the heart. There were two reasons for this art-making project, one was to encourage students to maintain and refine their artistic inclinations despite a challenging academic workload. The second reason was because we know that art-making, while training has side benefits for medical students including enhancing learning, discovering professional identity, bearing witness, and healing self and others. The relationship between art-making and medical student learning is the particular focus of this essay.

*Corresponding author: Carol Ann Courneya, Faculty of Medicine, University of British Columbia, Vancouver, Canada V6T 1Z3
E-mail: courneya@mail.ubc.ca

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Education meeting that I attended in the late 90s. In her workshop we, the participants, were each given a broad conceptual word prompt on a slip of paper, a Polaroid Camera (it was the 90s), and were invited to go outside and photograph “the concept” we had received. When we returned 30 min later, she laid out the photographs we had taken and we took turns explaining the link between the image and the concept. We made explicit our reasoning for selecting the image matched to the specific concept. My word was “invisible disability” and I photographed a disabled parking space and talked about whether, if I had a brain injury or debilitating fatigue, would I be afraid to be challenged if I parked there. It was a very enjoyable exercise and kept us all thoroughly engaged. I was intrigued with the combination of academic thought and creativity.

Back at my own University weeks later, I had the liberty to design the educational content and pedagogical processes for a multi week, teaching block of cardiac science for first-year medical and dental students. I decided to include an art-making project in the block. It was optional, and formative i.e. no grades attached. Specifically, I invited the medical/dental students to “conceptualize artistically” what they were learning in the context of the Cardiac Sciences block. At the time I had only one reason for doing this, and that was to encourage students to maintain and refine the artistic inclinations they brought to the study of medicine despite being immersed in a challenging academic workload. We now know however, that art-making, while training has side benefits for medical students, including enhancing learning, discovering professional identity, bearing witness, and healing self and others (Cox, Brett-MacLean, & Courneya, 2016).

To carry out this art project a local supplier gave me 25 disposable cameras (enough for one camera for each tutorial group of eight students), and agreed to shoulder the cost of development of the images. In addition, I invited those students who had fancy camera equipment of their own to submit cardiac-inspired images to a special “Photographers Choice” category. In truth, I had no idea if there would be an appetite by students for engaging artistically with a science concept, as all of this preceded what is now known as the “Arts and Humanities” in Medicine movement.

To my surprise and delight we had over 40 photographic submissions (at least one from each of the 25 tutorial groups, as well as 13 individual submissions to Photographers Choice category (see an example by Vreni Kuret from the Photographers Choice in Figure 1). The images were creative, interesting and illustrated a willing enthusiasm on the part of the medical students to think about cardiac science in an artistic way. I called the segment “Heartfelt Images” and it became an annual occurrence.

Figure 1. Heartfelt image by Vreni Kuret.

Note: This image can be found at teachingmedicine.com in the “Art Gallery”.

![Image of a stethoscope](image-url)
2. The heartfelt images

Fast forward 16 years, and Heartfelt Images remains a vital part of the cardiac learning for our medical and dental students. With the introduction of smart phones, it is now no longer necessary to give students cameras, as they carry one around with them in their phones. Early on students asked if they could submit non-photographic cardiac art, and within three years “Heartfelt Images” broadened to include other media. Now we get submissions across all media (e.g. paintings, sketches, collages, sculptures, installations and video).

From the onset, it was clear to me that many of the student's art submissions were more than “just pretty heart pictures”. Students were conceptualizing cardiac anatomy, physiology, and pathophysiology through art. In order to produce the art, students had to have a strong grasp of the science that explained the structure or function displayed.

An example of this is “Koi at Heart” by Michiko Maruyama (Figure 2), a painting submitted to Heartfelt Images in 2015. The image (Figure 2) shows a heart represented by two entwined Koi fish that, together, form an anatomically accurate heart. When the label overlay is in place you can see that the painting demonstrates all the correct anatomy. Maruyama was able to transfer what she understood about the science of the heart into an artistic representation. This process of going from something you learn in text to the creation of an image is called “transmediation” and according to Suhor (1984) and Siegel (1995) has the potential to invoke generative and reflective thinking in students. This “meaning-making”, according to students who engage in art-making, enhances their ability to remember what they learned.

Many students who created Heartfelt Images engaged in fanciful and metaphorical thinking. S. Fazel (Figure 3), sketched the heart as a beehive whose great arteries and veins became the links to the tree branches the hive was suspended on, while bees' exited the hive forming heart shapes. This delightful image was aptly titled “Sweetheart”. Metaphors, defined as objects used to represent something else, were used by the medical and dental students to represent the heart's structure and function. One example was a submission by A. Clark (Figure 4) where the powerful pumping heart was represented as a train's engine in her painting “Kokoromotive”. Clark states in her accompanying artist statement “Kokoro is the Japanese word for heart. In this piece, the Japanese Kanji symbol for koroko is featured on the right ventricle of the heart. A locomotive pumps oil, water, and steam to move a train as a heart pumps blood to move a body. They are the engines of their machines”.

Figure 2. Koi at heart by Michiko Maruyama.

Note: This image can be found at teachingmedicine.com in the “Art Gallery”. 
Figure 3. Sweetheart by Sadaf Fazel.

Note: This image can be found at teachingmedicine.com in the “Art Gallery”.

Figure 4. Kokomotive by Allizon Clark.

Note: This image can be found at teachingmedicine.com in the “Art Gallery”.
Metaphors have formed a longstanding part of medical learning. Pathologists have referenced food items as various pathophysiological conditions (e.g. strawberry cervix, blueberry muffin rash). This visual referencing of food items to label pathologies utilizes the element of surprise—(the familiar food name alongside a visual, histological specimen), that may enhance the learning process and may serve a transformational function that includes systematic mnemonic (memory enhancing) components (Carney & Levin, 2002; Levin, 1981).

The cardiac-inspired art submitted by dental students demonstrated a preference for kinesthetic learning. Their art submissions required considerable manual dexterity and hand–eye coordination in its creation. Pouya Bahrami, a dental student used a typodont (an educational tool used by dental students to practice clinical skills), to carve a heart into a tooth (Figure 5). In his artist statement, he remarked on his motivation: “to test my fine dexterity to create a heart crown, since the key to a patient’s heart is through a quality restoration”. According to the Canadian Dental Association website, students are selected for entry to dental school at least in part on their visual perception and manual dexterity. For that reason, it is not surprising that dental students exercised their artistic talents preferentially in a kinesthetic manner.

3. Coming full circle
As the Heartfelt Images repository of student-generated, cardiac-inspired art grew over the years, it became second nature for me to use examples in my lectures from the repository in order to supplement text-based physiological, anatomical, and pathophysiological explanations. Wolff Parkinson White is the name of a complicated cardiac arrhythmia that is due to the presence in the heart of an “accessory pathway” for electrical activity called the “bundle of Kent” and is characterized on a patient’s electrocardiogram (ECG) with:

- a “P” wave,
- a “delta” wave,
- a widened “QRS” wave,
- a “T” wave.
The panel image shown in Figure 6 was a visual representation of Wolff Parkinson White made in 2004 by medical student Paul Campsall. Panel 1 shows an “accessory pathway” and a pack of Kent cigarettes, Panel 2 is a wave made of peas, Panel 3 shows a person wearing a Greek delta symbol who is waving, beside a person with a “widened QRS” thanks to the artful placement of a pillow, and finally Panel 4 shows a wave made of tea. Students I showed this pictorial mnemonic to, have told me years later that they have never forgotten the image, and thus how to describe the characteristic ECG findings in a patient with Wolff Parkinson White syndrome.

In 2008, medical students Vy Nguyen and Matthew Yan submitted an image to illustrate the very low heart rate experienced by athletes, called “Athletic Bradycardia”. Their image (Figure 7) showed a very slow “electrocardiogram” constructed by inserting tennis balls into a mid-court net.

Both Campsall’s and Nguyen/Yan’s images have stood the test of time, and remain two of the “go-to” images that I use in lecturing about the cardiovascular system. But is there a pedagogical rationale for using mnemonomy? There is the pictorial superiority effect; where pictures and images are more likely to be remembered than text alone (Nelson, Reed, & Walling, 1976). In addition, Carney and Levin more recently showed that pictorial illustrations improve student’s learning from text (Carney & Levin, 2002). Whether this is borne out with medical student learning remains to be tested.

4. The future
With the explosion of the internet it is not surprising that medical students are taking their art-making online. Instagram, the mobile photo-sharing application, now provides the perfect venue to post and share images created by medical students. In the past five years, medical student artists have become regular online fixtures, posting weekly on Instagram. Three of the more prolific medical artists are @sarajclifford, a senior medical student in the UK and @mike.natter, a senior medical student in the USA both who (in 2017) have over 60,000 followers each and @insta_anatomy, a medical student in the UK who has 30,000 followers. The images posted by these medical artists are mostly ink and pencil crayon renderings. When you look at their posts over the four to six years of their medical training, there is an understandable evolution reflecting the progression through early years of basic science learning (anatomy, physiology, and pathophysiology) followed by several years of clinical learning. The nature of the images, therefore, become less about basic science and more focused on the clinical–patient experiences as they get closer to graduation. Mike Natter came to global internet attention after an interview about his medical doodles was posted on Buzzfeed (Lawrence, 2016). In that article he described how drawing helped him cope with the overwhelming volume of material in medicine. A recent 2016 Instagram post from @mike_natter was entitled “I learn by drawing”. When asked about drawing as a learning strategy, Natter stated “I believe that regardless of artistic skill level, we are all predominately visual learners. The amount of cortical real estate dedicated to visual processing far exceeds the other modalities especially compared to our puny hippocampus—why not harness some of that available visual real estate for learning and

![Figure 7. Athletic Bradycardia by Vy Nguyen and Matthew Yan.](image-url)
memory? It is the process of drawing notes and not necessarily the product, that allows one to truly understand and retain the information”. (October 2016, Personal Communication).

This idea of drawing as a learning strategy in science is reinforced in the literature. Sharron Ainsworth, Prain, and Tytler (2011) posits five reasons to recognize drawing by students as a pivotal tool in science education: drawing to enhance engagement, drawing to learn to represent ideas, drawing to reason, drawing as a learning strategy (integrating new and existing understanding), and drawing to communicate. The latter may be a useful skill for doctors to cultivate, as a way to communicate scientific explanations of diseases or procedures to patients.

Beyond drawing, medical students have used other modalities (painting, collage, sculpture and installation) as an adjunct to their learning (Courneya, Cujec, Joshi, & Dhital, 2017). As stated above the student’s choice of modality may be linked to their learning style (e.g. a kinesthetic learner choosing sculpture or installation).

The Heartfelt Images art project described above and the proliferation of online medical doodles are both examples of optional, extra-curricular endeavors. As outlined in articles included in a special issue of Academic Medicine (Special Theme Issue, 2003) and in two reviews of humanities in medical education (Cox et al., 2010; Kidd & Connor, 2008), the vast majority of arts-based offerings at medical schools are extra-curricular. It has been debated that artistic pursuits should be included in the curriculum and as such be assessed. There is debate about the utility of making creativity compulsory. Bristol University in the UK advocates for compulsory creativity in the context of their medical program requiring students to engage in drama, free writing, and submission of creative work in any media (Thompson, Lamontt-Robinson, & Younie, 2010). This raises the specter of assessment of creative work and Thompson emphasizes the importance of training faculty to be able to carry out such assessments. Wear and Zarconi (2011) fall on the “don’t assess” side of the argument, stating “there are areas of medical education involving reflectiveness, inquisitiveness, and imagination that should be off limits to the competency gaze”. I tend to agree. Not being formally assessed on your artwork, does not diminish the potential benefits accrued. Reflecting on my own experience, gathering over a decade of medical/dental student cardiac art, and regardless of the mode of expression, be it online or old school sketchbook, I believe students should be encouraged to explore their artistic inclinations while in medical school, with the hope that developing a practice that potentially enhances learning, provides a sanctuary from stress, and promotes a healthy work-life balance will bode well for a future as a healthy practitioner.

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Author details
Carol Ann Courneya1
E-mail: courneya@mail.ubc.ca
1 Faculty of Medicine, University of British Columbia, Vancouver, Canada V6T 1Z3.

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