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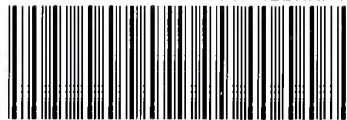
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IMPROVING MEDICAL OBSERVATIONAL SKILLS:  
Analyzing Fine Art in a Gallery Setting  
Versus a Workbook Simulator

Irish Margaret Maloney

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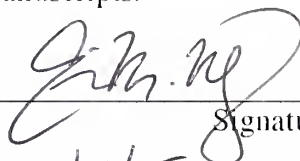
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**IMPROVING MEDICAL OBSERVATIONAL SKILLS:  
Analyzing Fine Art in a Gallery Setting Versus a Workbook Simulation**

**A Thesis Submitted to the  
Yale University School of Medicine  
in Partial Fulfillment of the Requirements for the  
Degree of Doctor of Medicine**

**by  
Erin Margaret Mahony**

**2005**



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## Abstract

### **IMPROVING MEDICAL OBSERVATIONAL SKILLS: Analyzing Fine Art in a Gallery Setting Versus a Workbook Simulation**

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The purpose of this study is to evaluate the significance of student-teacher interaction versus the medium of fine art in the conduct of the observational skills workshop at the Yale Center for British Art (YCBA). In addition, this study will assess the effectiveness of a fine arts workbook that emulates the workshop at the YCBA. Fifty-eight first-year medical students were randomized to one of three groups. The radiology group participated in an interactive observational skills workshop that utilized the traditional medium of radiographic images. The workbook group completed a fine arts workbook in an independent study environment that did not involve student-teacher interaction. The museum group participated in an interactive fine arts workshop at the YCBA. Improvement in observational skills was assessed with performance exams given before and after each intervention. The workbook group showed the most significant improvement from pre-test to post-test ( $p$ -value = 0.007). The radiology group also showed significant improvement in observational skills ( $p$ -value = 0.024). The museum group showed no difference between pre-test and post-test scores ( $p$ -value = 0.308). A follow-up study showed a trend toward improvement when students in the museum group were provided with question guides during the period of independent observation. The results of this study indicate that student-teacher interaction is not integral to the success of observation skills training, and show that a fine arts workbook is, in fact, an effective tool for teaching observational skills to medical students.



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## Introduction

If you should cut an onion through the middle, you could see and enumerate all the coats or skins which circularly clothe the center of this onion. Likewise if you should cut the human head through the middle, you would first cut the hair, then the scalp, the muscular flesh [galea aponeurotica] and the pericranium, then the cranium and, in the interior, the dura mater, the pia mater and the brain, then again the pia, the dura mater, the rete mirabile and their foundation, the bone. (1)

Leonardo da Vinci, one of the most accomplished artists in history, was also an anatomical genius. His narrative of the composite layers of the human head is so exquisite that readers do not need a background in medical education to obtain an accurate mental image. This description is one of many that accompany the hundreds of drawings of the human body penned by da Vinci for inclusion in his anatomical treatise of the human body. The drawings that comprise this collection are a tribute to da Vinci's "remarkable powers of observation [which] enabled him to exactly capture physical realities" and represent "the finest integration of the arts of anatomy and illustration ever achieved" (1). Each figure is accompanied by a brief description of its content, written in the reverse script da Vinci is known to have used for the purpose of limiting his readers to those astute enough to recognize its reversal. With the help of a mirror, the contents of his descriptions can easily be revealed (1). As such, da Vinci appears to demand of his readers the same degree of observational skill that he employs as an illustrator.

Although the relationship between art and medicine was recognized and exhibited by da Vinci centuries ago, it was not until the mid-1970s that a group of health professionals and artists gathered together for a series of discussions on the interrelatedness of these disciplines. These discussions were carried out under the sponsorship of the Institute on Human Values in Medicine. Reflecting eighteen months of dialogue, the group





subsequently published a series of insightful essays addressing the potential impact of humanities on the field of medicine. In the foreword to this collection of essays, Dr. Edmund Pellegrino identifies the important role of observational skill in the fields of medicine and art as he declares the following:

The clinician's craft begins with the eye – his essential diagnostic tool. With it he heeds the Hippocratic admonition to observe and to read the signs of illness impressed on the face and body of his patient...The artist's craft also begins with the eye. With it he records the work of nature and man's work upon nature. Like the physician the artist studies faces, forms, and colors...Clinician and artist are united in their need for a special visual awareness. Each sees; but for each, sight must transcend appearances. (2)

It is the responsibility of both artist and clinician to not only identify the outward characteristics of their respective subjects, but to also delve below the surface. Both are successful in their endeavors only after they attribute a deeper meaning to that which appears before them.

Geri Berg, an art historian and social worker who was formerly co-chairperson of the Program on Humanistic Studies at Johns Hopkins University School of Health Services, was a member of the committee gathered to discuss the connection between the visual arts and medicine. Speaking to the inferences that both clinicians and artists deduce from observation, he warns of the following:

The ability to make nonjudgmental or noninterpretive observations...as well as the ability to ask precise and insightful questions based on what is seen...is important to both the study of art and the practice of medicine...Both historians of art and practitioners of medicine would agree that the danger in too much interpretation based on assumption is not only that we may be wrong, but that we may continue to make judgments based on erroneous early information. (3)

Berg recognizes the subtle distinction that exists between assumptions and inferences. While an assumption involves the act of "taking as granted or true: suppos[ing]," an inference involves the act of "passing from one proposition, statement, or judgment



considered as true to another whose truth is believed to follow from that of the former,”

(4). When a clinician infers conclusions from what he has observed, he suggests possibilities that are grounded in concrete observations. Conversely, when a clinician makes assumptions, he declares certain ideas to be fact in the absence of tangible evidence.

Recognition of this distinction becomes especially important when discussing the teaching of observational skills as a component of medical education. Traditionally, undergraduate medical instruction in clinical observation has been based on the recognition of specific patterns of illness. Such instruction is especially important in the highly observation-dependent field of Dermatology. In a recent article describing a strategy for maximizing the undergraduate learning experience in Dermatology, S. M. Burge defines pattern recognition with eloquence:

[T]his type of clinical reasoning depends on the development of ‘illness scripts’ that are linked to encounters with real patients and that are expanded by adding specific information after future encounters with similar problems. ‘Illness scripts’ contain clinically relevant information about the particular problem and its presentation, key features, consequences and the context in which the problem develops. Clinicians draw on appropriate ‘illness scripts’ stored in their memory when solving new clinical problems and expertise is equated with rapid, efficient and accurate pattern-recognition. (5)

When learning how to approach a patient with a potential diagnosis, medical students are taught to consider a differential diagnosis: a list of possible diagnoses that can be ruled in or out based on clinical information. The understanding that individual illnesses tend to present with a specific constellation of signs and symptoms facilitates this process.

The importance of pattern recognition as a component of undergraduate medical education is evidenced by the development of a “surgical pattern recognition exam



(PAT)” at Wright State University School of Medicine in Dayton, Ohio. After administering the exam to third-year medical students, junior residents, and senior residents, the creators opine that the “surgical PAT examination is a new, reliable, and valid method for assessing diagnostic ability in third-year students,” (6). Interestingly, medical student performance on the PAT was significantly affected by the order of clinical rotations during the third year, while scores on the National Board of Medical Examiners Surgery Subject Exam were not affected by rotation order. In addition, senior residents performed significantly better on the PAT than junior residents. Taken together, these results indicate the dependence of pattern recognition on clinical experience (6). However, therein lies the limitation of pattern recognition as a strategy for teaching clinical observation: third-year medical students have minimal clinical experience on which to base their understanding of the patterns of illness.

The method of pattern recognition is not only limited by the lack of clinical exposure, but also by the tendency for students to make inappropriate generalizations early in their medical training. As Dr. John W. Denham recognized in 1981, “[t]he traditional dominance of disease in both research and education can lead to an oversimplified view of diagnosis. Most clinical learning is disease centered. This preoccupation with the diagnostic end point obscures the great variability of the starting point, a unique illness,” (7). When approaching a patient with an unknown diagnosis, it is important to consider the patterns of illness and thereby formulate a differential diagnosis. However, one must take care in doing this, so as not to overlook relevant details in an effort to fit each patient



into a known category of disease. The nuances of each patient's presentation become equally as important as the patterns of illness.

The ability to identify these details is relevant for people at all stages of medical education. For medical students, learning how to observe carefully enables them to improve their clinical skills, even in the absence of extensive exposure to clinical medicine. For residents, such visual astuteness helps to expand their growing repertoire of disease presentations. Dr. John Burnside, who was chief of the Division of Internal Medicine at the Hershey Medical Center during his involvement with the Institute on Human Values in Medicine dialogues on art and medicine, outlines the transition from medical student to attending physician as it relates to pattern recognition:

Towards the end of this period of didactic learning [college and the first two years of medical school], pattern recognition and departures from the normal are introduced... Even though the human subject is introduced, pattern recognition and the scientific process still prevail. The excitement and reward at this juncture are that the pattern exists in human beings and can be seen, felt, and heard...A recognition of variance begins to appear...Students' initial thrills of having thrown their fortune in the direction of a calling are soon displaced by the monotony of pattern recognition...Mature practitioners recognize that the real challenge is in the individual uniqueness of the human presentation of pattern. (8)

Third-year medical students may not yet have the experience to appreciate how the variations in presentation relate to their understanding of the patterns of disease. Their inexperience in the clinical milieu necessarily prevents them from focusing prematurely on the differential diagnosis. As such, medical students represent an ideal audience for instruction in observational skills.

The teaching of observational skills to medical students is not a new phenomenon. However, the success of previous efforts is debatable. As described by Denham,





“[f]ormal teaching of the observational skills needed in diagnosing illness is a time honored part of medical education. The analytic skills which follow diagnostic observations, however, are often obscure and poorly taught. Much of this deficit may be due to the special character of the teaching context,” (7). Changing the “teaching context” of observational skills training is a worthwhile consideration. Since it is medical students’ unfamiliarity with clinical presentations that enables them to best improve their observational skills, it follows that an ideal tool for such instruction would be something foreign to them, such as the visual arts. Similar to clinical medicine, analysis of fine art demands attentiveness and open-mindedness. Nonetheless, as a discipline, the arts are distinct from medicine. As early as the mid-1970s, Berg recognized the potential of applying art to medicine, as he asked the following questions, “Do artists have a special way of seeing? Does art focus our experience in ways that are enlightening, more satisfying, or disturbing to our notions of reality? Can we learn to become better observers, or to see more critically?” (3). Expanding upon this notion, W. Sherwin Simmons, an art historian who participated in the dialogues with Berg, defines an “aesthetic space” in which diagnostic skills operate and declares that “[i]n the employment of these skills, one of the most important components is an openness to the richness of the perceptual experience. It is crucial that attention not be prematurely focused or...related immediately to some preexistent category,” (9).

The recognition of the intersection between art and medicine led to changes in the curriculum of medical education following these dialogues. In fact, since the 1970s, medical education has benefited from a new association with art, largely in the form of



medical humanities. As a component of undergraduate medical education, medical humanities encompasses everything from the study of ethics to the use of art to reach emotion. Deborah Kirklin, Co-Director of the Center for Medical Humanities at the Royal Free and University College Medical School in London, England, identifies four advantages that the umbrella of humanities brings to medical training: 1) better understanding of patients' needs; 2) a form of understanding that is "qualitatively different" from the understanding traditionally achieved in the doctor-patient encounter; 3) a space for personal reflection on clinical experience; and 4) insight that is directly translatable to medical practice (10). Although the importance of the humanities is now recognized, the necessity of this field as an integral component of medical education is not reflected in current medical school curricula. Addressing this challenge, Dr. Lester D. Friedman, Senior Lecturer for the Program in Communication and Medicine at Northwestern University, declares the following:

[L]iterature and fine arts should not be inserted into the curriculum simply as "enrichment"; they should not be quarantined from the basic and clinical sciences but be used to contextualize the other components of medical training and practice. A broad range of medical humanities functions as indispensable preparation for a full, rich, and meaningful perception of medicine as a profession and its place within surrounding culture. (11)

Interestingly, resistance against formally integrating the arts into medical education exists despite proof of the positive impact that such an endeavor has on the training of future physicians.

In the early 1980s, Charles Stegeman was hired as a humanities fellow at the Medical College of Pennsylvania (MCP), as part of a program on "human values in medicine," (12). In an effort to bring to light the new appreciation for the use of visual art in medical education, Stegeman created a course entitled "Life Drawing," which lasted five weeks



and consisted of ten 90-minute sessions. During the year of its inception, he collaborated with Marilyn Appel, Ed.D., Assistant Dean for Undergraduate Medical Education at MCP, to conduct a study that examined the effectiveness of this course in teaching students to become better observers. In October of 1982, Stegeman invited all first-year medical students to test their observational skills by attending a screening session. During this session, the students were given twenty minutes to draw from a live model, with instructions to “draw what was observed as accurately as possible.” The drawings were then evaluated on the basis of a seven-point evaluation scale, with points awarded for detail, structure, and use of space. Those students who were deemed poor observers (score < 3) were invited to participate in the “Life Drawing” course. The eighteen students who participated in this course comprised the Experimental Group, while those students who were judged to be poor observers but declined participation in the “Life Drawing” course comprised Control Group 1 (C1). Those students who were found to be sufficient observers and thus not offered participation in the course formed Control Group 2 (C2). Assessment of improvement in observational skills was based on student performance on Anatomy and Pathology examinations. Students in the Experimental Group performed superiorly on the final Anatomy examination and the visually-dependent portions of the Pathology examinations. In conclusion, Appel et al. declare that “[t]he dramatic results of this research strongly suggest that by teaching medical students how to see more effectively they will be able to enhance their diagnostic skills and heighten their potential for excellence,” (13). Stegeman, a painter and Professor Emeritus at Haverford College, continues to teach a course in visual logic and conducts speeches to various groups on observation (12).



A different strategy for using the visual arts as a means of teaching observational skills to medical students was developed by Dr. Irwin Braverman, Professor of Dermatology at Yale University School of Medicine, in collaboration with Linda Freidlaender, Curator of Education at the Yale Center for British Art (YCBA). After concluding that the visual acuity of residents beginning their Dermatology training was deficient, Dr. Braverman decided to transform his passion for fine art into a functional role, and created an observational skills workshop for medical students. During the 1997-1998 academic year, he conducted a pilot program in which first-year medical students were taken to the YCBA to participate in an intensive workshop involving independent observation and small-group discussion of landscape and portrait paintings. Following the apparent success of the pilot program, a prospective study was performed by Jacqueline Dolev, former Yale Medical Student, during the 1998-1999 and 1999-2000 academic years. This study, conducted under the guidance of Dr. Braverman, became Dolev's medical school thesis. During the 1998-1999 academic year, all first-year medical students at Yale University School of Medicine were randomly assigned to the control group, intervention group, or lecture group. The control group attended their regularly scheduled clinical tutorial sessions; the intervention group attended the workshop at the YCBA; and the lecture group attended a regularly scheduled Anatomy lecture about reading abdominal X-rays. During the 1999-2000 academic year, students were randomized to only the control group or intervention group. Improvement of observational skills was evaluated with performance exams given before and after each intervention. During these exams, students were asked to describe photographs of patients with different dermatological conditions. The exams were then scored blindly





using a predetermined key. The results indicated that the observational skills of medical students attending the workshop at the YCBA significantly improved, whereas the observational skills of students in the control and lecture groups were unchanged (14).

The success of the workshop at the YCBA was internationally recognized, with the publication of a Research Letter in the September 5, 2001 issue of *JAMA* (15). Not surprisingly, many other medical schools have since incorporated the visual arts into their undergraduate medical curricula. One such medical school is Weill Cornell Medical College, which collaborated with The Frick Collection, a private art museum in New York, to create a museum workshop similar to that initiated by Dr. Braverman (16). Unfortunately, not all medical schools are situated near an art museum that contains historical paintings with the level of detail present at the YCBA. Bringing the paintings at the YCBA to other medical schools in the form of a workbook could provide medical students at other universities with a similar opportunity for training in observational skills. However, transferring the workshop experience from the YCBA to the classroom setting could potentially lessen its effectiveness. In the previous study, Dolev only examined the use of fine art as a tool for improving the observational skills of medical students in the context of the museum workshop. Therefore, it was unclear whether the dynamic nature of the museum workshop, which involves considerable student-teacher interaction, was integral to its success. To clarify this ambiguity, a new study was conducted.



## **Hypothesis**

This study will evaluate the relative contributions of the medium of fine art and the student-teacher interaction to the success of the workshop at the YCBA. To that end, this study will compare the effectiveness of analyzing fine art versus radiographic images in improving the observational skills of medical students. In addition, this study will assess the efficacy of an independent study workbook that emulates the workshop at the YCBA. Three hypotheses will be tested with this study: 1) the workshop at the YCBA will be more effective than the fine arts workbook in improving the observational skills of medical students; 2) the workshop at the YCBA will be superior to an observational skills workshop that uses the traditional medium of radiographic images; and 3) the analysis of radiographic images in an interactive workshop setting will be more effective than the analysis of fine art in an independent study workbook as a means of improving medical observational skills.



## **Methods**

### ***Study Design***

During the 2002-2003 academic year, all first-year medical students were recruited for participation in this study. The volunteers were randomly assigned to one of three groups: museum group, radiology group, or workbook group. The museum group represented the experimental group and involved the use of fine art to teach observational skills in the setting of an interactive workshop. The radiology group represented one of the control groups and employed radiology to teach observational skills in an interactive workshop setting. The workbook group represented the second control group and involved the use of fine art to teach observational skills in the setting of independent study. Two important features of the experimental group, the use of fine art and the interactive workshop setting, were controlled as independent variables by using two control groups. Evaluation of improvement in observational skills was assessed using performance exams given before and after each intervention.

### ***Participants***

Approximately sixty percent of the first-year class (58/100) participated in the study. In an effort to maximize the number of participants and recruit a representative group of students, all participants were given a monetary reward for their involvement. Of the fifty-eight participants, nineteen students were randomly assigned to each the museum group and the radiology group, and twenty students were randomly assigned to the workbook group.



### *Museum Group*

Since the success of Dolev's original study, Yale medical students have attended a mandatory workshop at the YCBA in the spring of their first year. This workshop represents one of a series of workshops that conclude the first-year component of the Pre-Clinical Clerkship (formerly entitled Doctor-Patient Encounter), a two-year course designed to teach students the skills necessary to become competent medical students during their clinical years.

For the exercise in observational skills, students attend a workshop at the YCBA that is organized by Dr. Irwin Braverman and Linda Freidlaender. Approximately twenty students attend each of five identical workshops in March or April of their first year. Following introductory comments, the students are separated into groups of four or five students, and each group is led by a museum docent, Dr. Braverman, or Linda Freidlaender. Each student is assigned to one painting and given ten minutes to observe the painting carefully. The paintings are selected on the basis of their intricate detail, necessitating vigilant observation by the viewer.

The students in each group are then brought together again, and each of the students presents the story of his painting to the group. The guidelines for these presentations mimic those of patient presentations, and the student is asked to describe the story of his painting in such a way that a person who has not seen the painting could obtain a mental image from his description. Students are encouraged to begin their presentations with a one-sentence description of what is being depicted in the painting, just as they would





begin the presentation of a patient to an attending physician. In describing the story, the student is encouraged to draw conclusions that are supported by observations and not make assumptions. For example, a student may only declare that a painting involves a night scene by supporting this claim with the observation of a dark sky highlighted by stars and a crescent moon. The group leaders encourage the students to approach the paintings systematically, by addressing the size of the painting, the figures included in the scene, and the structural and geographic elements that compose each story. In addition, the leaders facilitate the discussions by asking open-ended questions that guide the observer to important details of the painting. Finally, the group leaders end the discussion of each painting with a description of its story, as portrayed in art history textbooks.

The workshop concludes with a presentation to the larger group of twenty students. During this presentation, Dr. Braverman reflects on the exercise and discusses pattern recognition as an additional form of observational skills training that is distinct from observational skills training at the YCBA, which emphasizes fine detail in the unfamiliar medium of fine art. Using a slide show presentation, Dr. Braverman demonstrates pattern recognition in the world around us, and more specifically, in the world of medicine. The entire workshop lasts approximately two hours.



### ***Radiology Group***

As part of their Anatomy course, all first-year medical students participate in five intensive radiology workshops. Since the field of Radiology provides most physicians with one of their primary windows into human anatomy, the radiology component of the Anatomy course at Yale is significant. In fact, many of the final exam questions require radiographic analysis and recognition of normal human anatomy on X-rays, CT scans, or MRIs.

The radiology workshops are spaced out over the six-month Anatomy course, with the final workshop occurring in January. Students participate in these workshops with their dissection groups, which consist of four or five students. Each workshop involves a series of four or five cases, which are designed as exercises in observation. Each case utilizes X-rays, CT scans, and/or MRIs that depict normal anatomy. The students are provided with a list of questions that guide them through the exercise and direct their attention to the structures of interest. Students work together to answer the questions and identify the relevant structures. Radiologists facilitate the workshops by assisting students when they encounter difficulty during the exercise. Each group usually requires approximately thirty minutes to complete the workshop. After answering the questions provided, students often continue to analyze other components of the radiographic images, and frequently engage in extensive discussion with each other and with the radiologists in attendance. An excerpt from one of the cases utilized during the radiology workshop is presented in Figure 1. In the actual workshop, a series of CT scans showing



coronal slices of the head accompanied the portion of the handout displayed in this figure.

**Figure 1**  
**Representative Radiology Workshop Case**

RADIOLOGY: HEAD AND NECK LABORATORY  
Jim Abrahams, M.D.  
Department of Diagnostic Radiology  
Yale University School of Medicine

CASE 1

For orientation, it is helpful to think of four levels: eyes, nose, mouth, and larynx.

1. Eyes

- Image 1. What are the air-filled structures between the orbits? Right, they are the ethmoid sinuses. Just posterior to them is the air-filled sphenoid sinus in the midline.
- Image 2. Identify external auditory canal on right. What is the air in the bone just posterior to it? Right, the mastoid air cells.
- Why don't you see the left external auditory canal on image 2? Because the head is tilted. Look on image 4 for the left external auditory canal.

2. Nose

- Image 7. Identify triangular-shaped air-filled maxillary sinuses. What is the vertically oriented white linear structure in the midline between the maxillary sinuses? Right, nasal septum.
- What are the two vertically oriented structures between the maxillary sinuses and the nasal septum? Right again, the nasal turbinates within the nasal cavity.
- What is the midline air-filled structure just posterior to the nasal turbinates? Correct, the nasopharynx. On image 6, find the two bumps that protrude into the nasopharynx on either side. This is the torus tubarus. The air-filled recess anterior to it is the eustachian tube and the one posterior is the lateral pharyngeal recess.

For this study, the final radiology workshop that occurs in January was used. This particular workshop was chosen in an effort to minimize any difference in the level of



observational skills training that students in the different study groups had received prior to participation in the study. Between the final radiology workshop and the session at the YCBA, there were no other intensive exercises in observational skills training.

Therefore, students randomized to the workbook or museum groups had the advantage of five prior radiology workshops, whereas students randomized to the radiology group had only completed four radiology workshops prior to study participation.

### ***Workbook Group***

For use in this study, a workbook was created that replicates the museum experience and places the exercise in the setting of independent study. The workbook is divided into four sections that each contain the following: 1) a digital picture of one of the paintings at the YCBA that is used during the museum workshop; 2) blank pieces of paper on which to record observations and tell the story of the painting; 3) a list of open-ended questions intended to guide the observer toward important details in the painting, similar to the questions posed by the group leaders during the museum workshop; 4) a list of responses to the questions provided; and 5) a written description of the contents of the painting, as portrayed in art history textbooks.

Twenty students participated in the workbook exercise 1-2 weeks prior to attending their assigned workshop at the YCBA. The students were gathered together in the evening and asked to complete the workbook according to specific instructions. Fifteen minutes were provided for the completion of each of the four sections. Students were asked to spend the first few minutes looking carefully at the digital picture of the painting. They spent





the next 7-8 minutes writing down their observations on the blank pieces of paper.

Similar to the exercise at the art museum, students were encouraged to begin their written analyses with a one-sentence description of what is being depicted in the painting, just as they would begin the presentation of a patient to an attending physician. The importance of avoiding speculation and not making assumptions about the content of the paintings was emphasized in written directions. Students were encouraged to utilize the list of questions to guide them to relevant details *after* their initial analysis. During the last five minutes, students were asked to study the list of responses and encouraged to revisit the digital picture of the painting. At the conclusion of each section, students were allowed to read the description of each painting that was compiled from art history textbooks. Students were asked to complete this exercise independently, without discussion with their neighbors or input from instructors. The exercise was facilitated by Dr. Braverman and the author of this thesis, and lasted approximately one hour. A sample digital picture with excerpts from the associated questions and suggested responses is presented in Figure 2.



**Figure 2**  
**Representative Workbook Selection**

**The Death of Chatterton**  
By Henry Wallis



**Questions to Consider:**

- What is going on in this painting?
- Is the young man sleeping, dead, or comatose?
- Is the position of his body natural?
- How old is the young man?
- In what room is this scene taking place? Consider all possibilities.

**Suggested Responses to Questions:**

- What is going on in this painting?  
A young man is sprawled out on a bed in a dark room while a pile of crumpled papers and an empty bottle lay in a chest and on the floor next to him.
- Is the young man sleeping, dead, or comatose?  
At first glance, any scenario appears possible. His eyes are closed and he is lying on a bed, which might initially lead the viewer to assume that he is asleep. However, upon closer examination, the grayish tint of his face suggests that something is wrong. Perhaps he is dead or comatose.
- Is the position of his body natural?  
Adding to the suspicion created by the gray color of his face is the unnatural position of his body. His torso and lower body are bent in opposing directions. In

(continued)



## Figure 2 Continued Representative Workbook Selection

addition, he is lying flat on his back while resting on his right hip. This position does not appear to be natural; rather, it appears forced and painful. One could argue that this young man has passed out after a night of drinking alcohol; however, the grayish tint of his face must also be considered. Taken together, the color of his skin and the unnatural position of his body finally lead the viewer to conclude that this young man is dead or comatose, with the color of his skin implying death. Interestingly, the position of his body is reminiscent of that of Jesus in *The Pieta* or, rotated ninety degrees clockwise, of Jesus nailed to the Cross.

- How old is the young man?  
Judging by his nearly full-grown stature (as best as can be deduced while he is lying down) and his still underdeveloped face and chest, it is likely that this young man is in his late teens.
- Where is this scene taking place? Consider all possibilities.  
The cramped and dark appearance of the room initially suggests two possible locations: a basement or an attic. Through the window, the roofs of other houses can be seen, suggesting that this room is in the attic. However, it remains possible that this house resides on a hill; therefore, a view from the basement could still overlook the roofs of neighboring houses. Further examination, however, reveals that the slant of the wall next to the window is indicative of a room located in the attic.

### *Performance Exams*

Prior to participating in either workshop or completing the workbook, students were given a set of photographs of three patients with dermatological conditions (set A, with photographs numbered 1, 2A, 2B, 2C, and 3). Some photographs contained specific body parts of patients, while others depicted the entire patient. The ages of the patients were variable. For each patient, the students were asked to spend approximately thirty seconds observing the photograph(s). Students were then given three minutes to record their observations on a blank piece of paper. An additional minute was given for patient #2, in order to accommodate the fact that three different photographs of this patient were included in the set. Students were asked to describe the photograph in such a way that



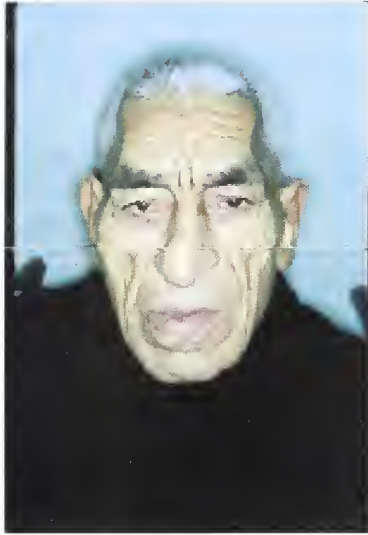
the reader would be able to create a mental image of the photograph based on each student's written observations. A similar exercise was repeated after completion of the workshops or workbook, using a different set of photographs of different patients (set B, with photographs numbered 4, 5, and 6). During Dolev's original study, it was determined that set A and set B were of equal difficulty. Therefore, no inherent bias towards improvement or deterioration existed in using set A for the pre-test and set B for the post-test.

Predetermined criteria were utilized for scoring the students' observations, and scoring was performed under blinded conditions by Dr. Braverman and the author of this thesis. Points were awarded for ten expected observations (0.5 point each for gender and age; 1 point for all other expected observations). Certain observations that were not expected were credited 1 point under the category of "other." These observations included the following: for photograph 1, the mole under the man's right eye; for photograph 4, the mole/birthmark on the woman's sternum. Therefore, a maximum of ten points was awarded for each photograph. An example of one of the photographs and the list of expected observations for this photograph are presented in Figure 3. Also included in this figure is an example of one student's observations for this photograph.





**Figure 3**  
**Representative Test Photograph and Sample Response**



Expected Observations

Elongated face  
 Thickened skin/wrinkles  
 Swollen features ( $\geq$  two for credit)  
 Temple atrophy  
 Watery/pink eyes  
 Slanted nose/asymmetric mouth  
 Teeth in poor condition  
 Bags under eyes  
 Gender  
 Age  
 Other (mole near right eye)

Student Observations

Elderly male (early 70s) with gray/white hair  
 Long, thin face with extensive wrinkles and "loose" skin  
 Prominent nose  
 Brown eyes with significant bags underneath  
 Large ears that are relatively flat against the head  
 Black sweater  
 Mouth is slightly up-turned with a prominent bottom lip  
 missing a couple teeth on the bottom (can't see upper teeth)

***Follow-up Study***

Upon initial review of the data, it was recognized that participants in the radiology and workbook groups had the opportunity to utilize a list of questions that directed their attention toward important elements of the image being observed. In contrast, the



museum group did not have this opportunity during the initial period of independent observation. Rather, the group leaders raised such questions during the small-group discussions that followed the initial period of observation at the museum. In an effort to determine whether the use of such questions during the period of independent observation had an impact on the effectiveness of the exercise, a follow-up study was performed in the spring of 2004.

During the spring of 2004, participants in each of the five identical workshops at the YCBA were alternately given or not given a list of questions to direct their independent observation. The question lists were identical or analogous to those included in the workbooks. The students who attended the workshops dated 3/25, 4/15, and 5/6 received question guides, while those students who attended the workshops dated 4/1 and 4/30 did not receive question guides. In total, 48 students were provided with question guides and 31 students were not provided with question guides. Students were randomly assigned to attend the workshop at the YCBA on a particular day. The assumption was made that all students had an equivalent foundation in observational skills and no pre-test was conducted. All students were required to participate in a post-test comparable to that used in the initial study. An example of the question guide used for one of the paintings at the YCBA is displayed in Figure 4.



**Figure 4**  
**Representative Question Guide Used in Follow-up Study**

**The Death of Chatterton**  
By Henry Wallis

- What is going on in this painting?
- Is the young man sleeping, dead, or comatose?
- Is the position of his body natural?
- How old is the young man?
- In what room is this scene taking place? Consider all possibilities.
- What time of day is it?
- How long has the young man been in this state?
- What do you notice in the young man's hand and on the floor?
- What do these things suggest?
- How would you describe the appearance of the room, with special attention to the area defined by the window and the windowsill?

*Statistical Methods*

Data was entered into Microsoft Excel spreadsheets and analyzed using both Microsoft Excel and SPSS 13.0. Microsoft Excel was used to quantify means, standard deviations, and  $p$ -values using the  $t$ -test function. A significant  $p$ -value was defined as  $\leq 0.05$ . SPSS 13.0 was used to perform one-way analyses of variance (ANOVA). Graphs were generated using Microsoft Excel.



## Results

### *Year 2003*

The percentage of expected observations that were correctly identified during the performance exams was calculated for each student. The mean pre-test percent correct for the radiology, workbook, and museum groups was 48.7%, 48.9%, and 50.4%, respectively. The mean post-test percent correct for the radiology, workbook, and museum groups was 53.5%, 54.2%, and 51.5%, respectively. Comparison of the pre-test and post-test scores reveals a significant improvement for the radiology and workbook groups ( $p$ -value = 0.024 and 0.007, respectively). The museum group showed no significant difference between pre-test and post-test scores ( $p$ -value = 0.308). The mean pre-test and post-test scores for each group, as well as the results of the  $t$ -test, are displayed in Table 1.

**Table 1**  
**Descriptive Statistics for 2003 Data**

	<b>Radiology Group</b>	<b>Workbook Group</b>	<b>Museum Group</b>
<b>Number of Subjects</b>	19	20	19
<b>Mean Pre-test % Correct</b>	48.7 ( $\pm$ 11.0%)	48.9 ( $\pm$ 8.7%)	50.4 ( $\pm$ 9.3%)
<b>Mean Post-test % Correct</b>	53.5 ( $\pm$ 7.6%)	54.2 ( $\pm$ 7.9%)	51.5 ( $\pm$ 7.2%)
<b><math>p</math>-Value</b>	0.024	0.007	0.308





The pre-test scores were compared between groups to determine whether or not there was a difference in the foundation of observational skills possessed by the subjects in each group. The results of the one-way ANOVA indicate that the pre-test scores were not significantly different between groups ( $p$ -value 0.848). The post-test scores were similarly compared between groups using a one-way ANOVA, which showed no significant difference in the post-test scores between groups ( $p$ -value = 0.523). Finally, the differences between pre-test and post-test scores were compared between groups using a one-way ANOVA, and the results indicate that the score differences did not significantly vary between groups ( $p$ -value = 0.340). The results of the one-way ANOVA for the pre-test and post-test scores and the pre-test and post-test score differences are displayed in Table 2.

**Table 2**  
**One-way ANOVA Results for 2003 Data**

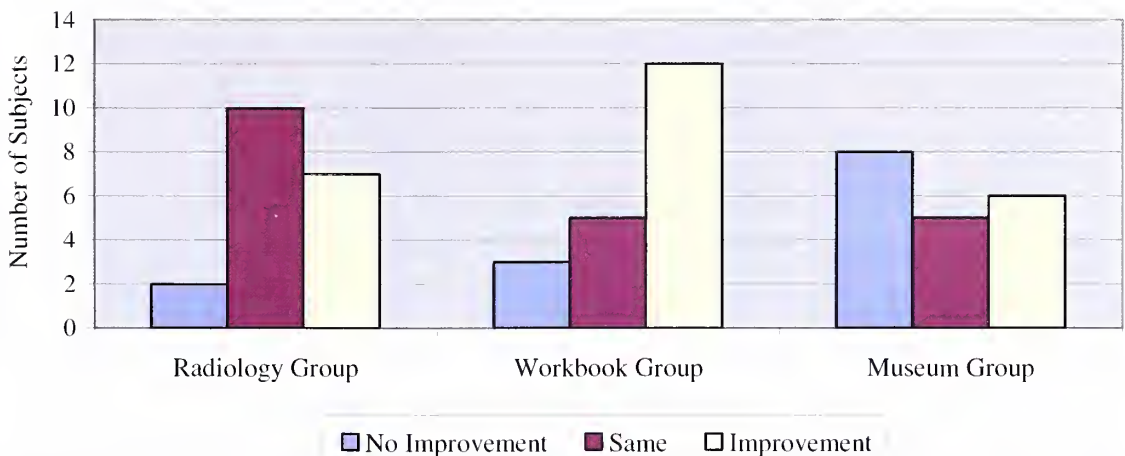
	<b>Sum of Squares</b>	<b>Degrees of Freedom (<i>df</i>)</b>	<b>Mean Square</b>	<b>F-ratio</b>	<b><i>p</i>-Value</b>
<b>Pre-test % Correct</b>	31.120	2	15.560	0.166	0.848
<b>Post-test % Correct</b>	75.068	2	37.534	0.656	0.523
<b>Pre-Post Difference</b>	196.322	2	98.161	1.100	0.340

The distribution of the differences between pre-test and post-test scores was analyzed for each group in order to identify the proportion of participants who showed improvement versus those who did not show improvement. The score differences were categorized as follows: no improvement = pre-test and post-test difference  $\leq -5\%$ ; same = score



difference  $>-5\%$  and  $<+5\%$ ; improvement = score difference  $\geq +5\%$ . For the radiology group, 2 students showed no improvement, 10 students scored the same, and 7 students showed improvement. For the workbook group, 3 students showed no improvement, 5 students scored the same, and 12 students showed improvement. Finally, for the museum group, 8 students showed no improvement, 5 students scored the same, and 6 students showed improvement. The distribution of the pre-test and post-test score differences for each group is displayed graphically in Figure 5.

**Figure 5**  
**Score Distribution By Group**



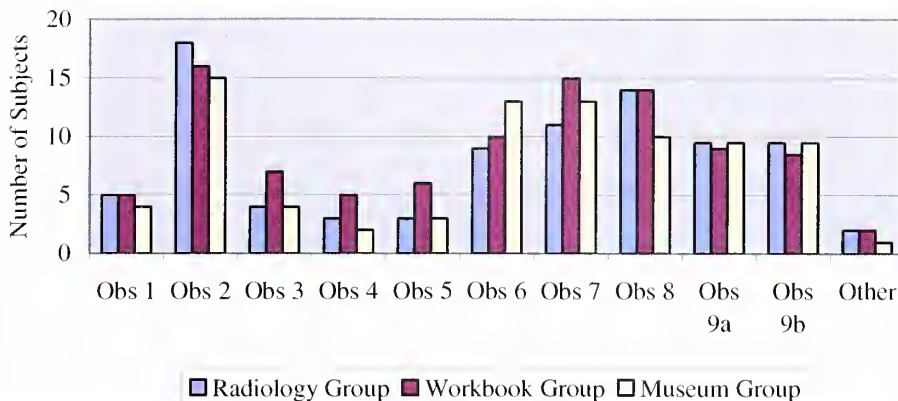
No Improvement = Pre-test and Post-test Difference  $\leq -5\%$ ; Same = Score Difference  $>-5\%$  and  $<+5\%$ ; Improvement = Score Difference  $\geq +5\%$

The number of participants who correctly identified the expected observations was calculated for each photograph and compiled into histograms. Figures 6, 7, and 8 show these histograms and the associated lists of expected observations.

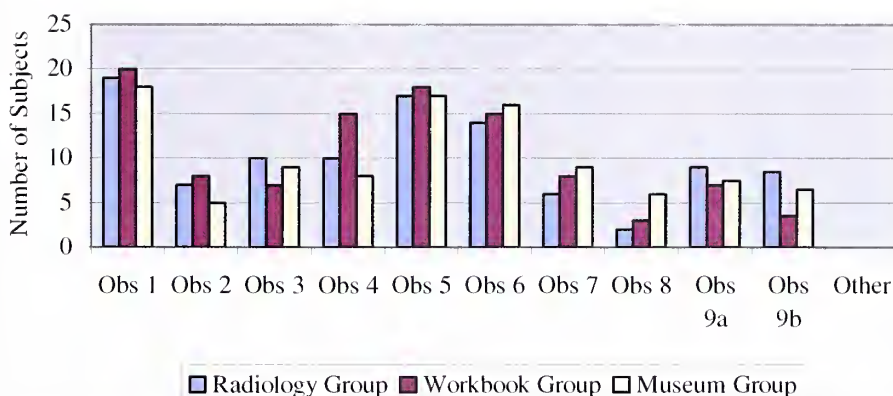


**Figure 6**  
**Observation Analysis of Test Photographs 1 and 2**

**Photograph 1**



**Photograph 2**



Photograph 1

Obs 1 Elongated face  
 Obs 2 Thickened skin/wrinkles  
 Obs 3 Swollen features  
 Obs 4 Temple atrophy  
 Obs 5 Watery/pink eyes  
 Obs 6 Slanted nose/asymmetric mouth  
 Obs 7 Teeth in poor condition  
 Obs 8 Bags under eyes  
 Obs 9a Gender  
 Obs 9b Age  
 Other

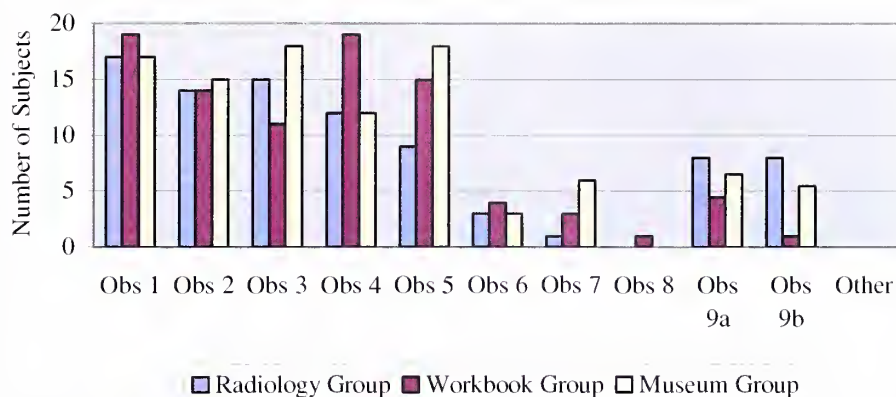
Photograph 2

Obs 1 Back  
 Obs 2 Moles/freckles/pimples  
 Obs 3 Tan marks  
 Obs 4 Scoliosis  
 Obs 5 Three spots  
 Obs 6 Coffee-colored  
 Obs 7 Irregular border  
 Obs 8 Stops at midline  
 Obs 9a Gender  
 Obs 9b Age  
 Other

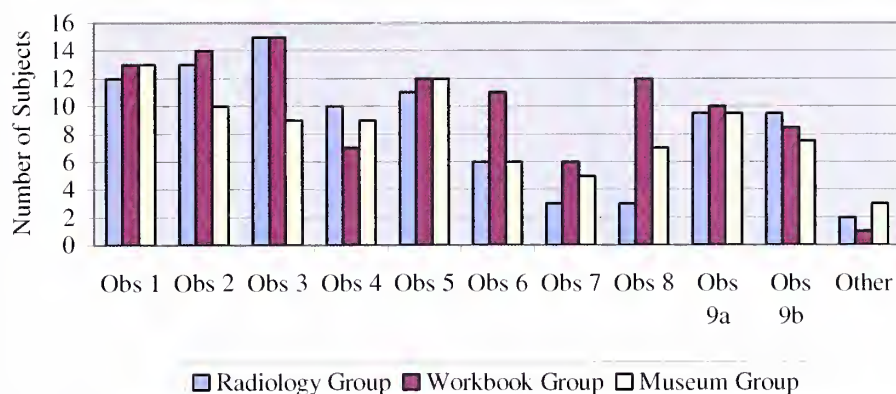


**Figure 7**  
**Observation Analysis of Photographs 3 and 4**

**Photograph 3**



**Photograph 4**



Photograph 3

Obs 1 Back of arm  
 Obs 2 Lesions extended to shoulder  
 Obs 3 Hair on arm/in axilla  
 Obs 4 Lesions in clusters  
 Obs 5 Description of individual lesion  
 Obs 6 Varying size of clusters  
 Obs 7 Varying size of lesions in clusters  
 Obs 8 Linear dermatome  
 Obs 9a Gender  
 Obs 9b Age  
 Other

Photograph 4

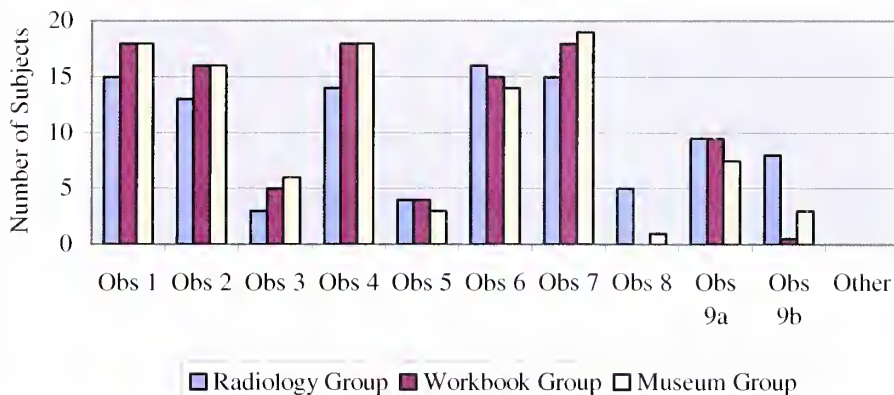
Obs 1 Increased pigmentation  
 Obs 2 Jaundice/yellowish skin  
 Obs 3 Scleral icterus  
 Obs 4 Xantholasmias  
 Obs 5 Xanthomas on elbows  
 Obs 6 Cachectic  
 Obs 7 Hollowed neck  
 Obs 8 Unkempt hair  
 Obs 9a Gender  
 Obs 9b Age  
 Other



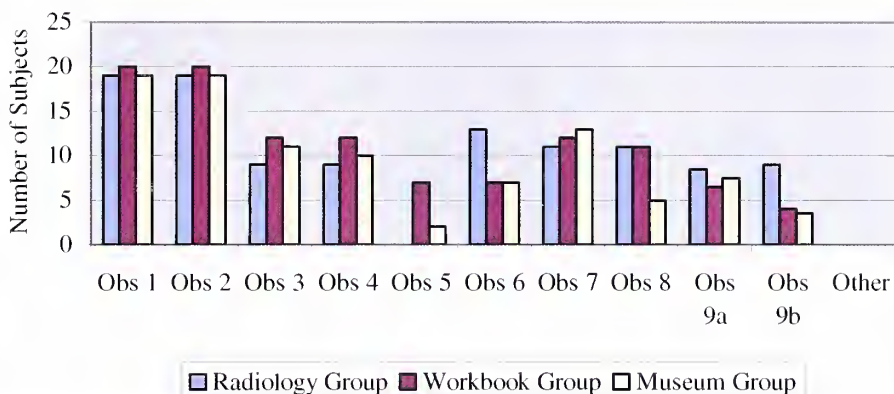


**Figure 8**  
**Observation Analysis of Photographs 5 and 6**

**Photograph 5**



**Photograph 6**



Photograph 5

Obs 1 Flank  
 Obs 2 Arc or wave form  
 Obs 3 Bumpy then confluent  
 Obs 4 Obese  
 Obs 5 Three waves/streaks  
 Obs 6 Red spot  
 Obs 7 Orange/red color  
 Obs 8 Lesions extending to leg  
 Obs 9a Gender  
 Obs 9b Age  
 Other

Photograph 6

Obs 1 Blotches on chest/forearms  
 Obs 2 Red/orange color  
 Obs 3 Non-uniform/brighter chest  
 Obs 4 Discreet/darker on arms  
 Obs 5 T-shirt distribution spared  
 Obs 6 Thin skin/veins on arms  
 Obs 7 Folded/crossed arms  
 Obs 8 Obese  
 Obs 9a Gender  
 Obs 9b Age  
 Other



**Year 2004**

The percentage of expected observations that were correctly identified by each student was calculated for the post-test according to the same formula used for the 2003 data.

The mean post-test percent correct for the museum group without questions was 52.0%, while the mean post-test percent correct for the museum group with questions was 54.1%. The difference between these scores is not significant ( $p$ -value = 0.169). The mean post-test scores and the results of the  $t$ -test are displayed in Table 3.

**Table 3**  
**Descriptive Statistics for 2004 Data**

	Number of Subjects	Mean Pre-test % Correct	Mean Post-test % Correct
<b>Museum (w/o Questions)</b>	31	NA	52.0 ( $\pm$ 10.6%)
<b>Museum (w/ Questions)</b>	48	NA	54.1 ( $\pm$ 8.4%)
<b><math>p</math>-Value</b>	NA	NA	0.169

The similarity between the mean post-test percent correct for the museum group without questions in 2004 (52.0%) and the mean post-test percent correct for the museum group in 2003 (51.5%) reinforces the consistency of the study design between the two years.

Based on the assumption that the pre-test scores for the museum groups in 2004 would be similar to those of the museum group in 2003, a hypothetical pre-test and post-test score comparison can be performed for the museum groups in 2004. Comparison of the post-test scores for the museum groups in 2004 to the pre-test scores for the museum group in 2003 shows a trend toward improvement when the museum workshop is conducted with



questions (p-value = 0.0596) and no change when the workshop is conducted without questions (p-value = 0.291).



## Discussion

This study was designed to determine whether the use of a workbook that emulates the observational skills workshop at the YCBA is an effective alternative to the museum workshop. It is evident from the results of this study that the use of a fine arts workbook is, indeed, an effective method of teaching observational skills. In fact, the improvement seen in the students who participated in the workbook exercise was greater than that seen in either the students who participated in the radiology workshop or the workshop at the YCBA. The success of the workbook exercise provides further evidence for the important role that the visual arts can play in undergraduate medical education.

Interestingly, the success of the workbook exercise actually surpassed that of the museum workshop. Two possible explanations for this deserve specific mention. First, there is an inherent selection bias in this study, stemming from the fact that all of the participants are medical students at an institution that carefully selects students who are self-motivated learners. Given this fact, it is not surprising that such students would excel at a task that requires motivation and concentration in an independent setting. Second, the workbook exercise provided more direction to the students than the workshop at the YCBA.

Included in each section of the workbook is a list of open-ended questions intended to guide the observer toward important details of the painting. Students were asked to look at this list of questions only after their initial analysis. However, during the exercise, it became apparent that most students were using these questions to guide their initial analysis. Similarly, the radiology workshop provided students with a list of questions that highlighted important elements of the images being observed. Therefore, students in





both the radiology and workbook groups possessed an inherent advantage over students in the museum group that was not initially recognized. It is possible that this added direction enhanced the effectiveness of the workbook exercise and the radiology workshop.

In an effort to assess the validity of the hypothesis that providing the observer with open-ended questions during the period of independent analysis imparted an educational advantage, a follow-up study was conducted. When the post-test scores of the students who participated in the follow-up study with questions were compared to the pre-test scores of the students who participated in the museum workshop in the 2003 study, there was a trend toward improvement in score. However, when a similar comparison was made for the students who participated in the follow-up study without questions, no change in score was appreciated. Therefore, it appears that the effectiveness of the museum workshop may, in fact, be increased by the incorporation of open-ended questions to direct the viewer during the period of independent observation.

While the participants in the workbook exercise showed the most significant improvement in observational skills, the improvement seen in the participants in the museum workshop was not significant. This is especially surprising given the statistical significance of the improvement seen in the original study performed by Dolev.

Although the museum workshop component of both studies was similar, two important differences between the studies should be noted. First, the number of subjects included in Dolev's study was greater than the number of subjects assessed in this study. The



number of subjects included in this study was limited by the willingness of students to participate in the study. Furthermore, the total number of volunteers was necessarily divided into three groups and the study was performed over one academic year.

Therefore, the three groups of subjects each contained only nineteen or twenty students.

The small number of subjects in each group limits the power of the study, and thereby limits the ability of the study to detect small, but significant, differences in score. The second difference between the study performed by Dolev and this study relates to the group leaders at the YCBA. In the original study, only Dr. Braverman and Linda Freidlaender, the co-creators of the museum workshop, facilitated the small-group discussions at the YCBA. Thus, both group leaders in Dolev's study were intimately aware of the objectives of the museum workshop. For the current study, docents functioned as group leaders, in addition to Dr. Braverman and Linda Freidlaender, in order to accommodate the greater number of students per workshop. It is possible that the docents were not as effective in their role as group leaders, given their relative unfamiliarity with the workshop goals. In the future, more explicit training of docents prior to the museum sessions will likely increase the effectiveness of the workshop.

Given the success of the workbook exercise in comparison to the workshop at the YCBA, the question arises of whether it is necessary to bring students to the YCBA. Perhaps the use of fine arts to teach observational skills can be successfully incorporated into the classroom curriculum without the logistical complications of leaving the medical school community. However, before drawing such a conclusion, it is important to consider all of the benefits gained from the workshop at the YCBA, not just those assessed in this



study. In addition to the improvement in observational skills gained by students who participate in the museum workshop, important skills in communication may also be enhanced. Essential to the role of a physician-in-training is the ability to present patient information to other medical personnel in an accurate and coherent fashion. Such a skill is best improved by experience in communicating observations and assessments, and the workshop at the YCBA provides a forum for gaining such experience. Following the period of independent observation at the art museum, students are asked to describe the paintings they studied to the group, using a structure of presentation similar to that used when presenting patients to an attending physician. The nonjudgmental setting of the art museum provides students with an opportunity to improve their communication skills in a setting that is both comfortable and supportive. While effective in teaching observational skills, the workbook exercise does not provide the same opportunity for verbal communication. In fact, the participants' want for group discussion during the workbook exercise was witnessed firsthand, as they began openly conversing about the paintings and the descriptions provided during the short breaks between workbook sections. Although such discussion was not intended, it was indicative of the importance of verbal communication in the teaching of observational skills. The contribution of the interactive setting at the YCBA to improvement in students' presentation skills is an interesting relationship and should be studied further in the future.

Alongside the success of the workbook exercise, the success of the radiology workshop deserves recognition. The incorporation of the radiology workshops into the first-year Anatomy curriculum is clearly an effective means of teaching observational skills.



Moreover, such a system enables medical students to transfer the understanding of human anatomy that is gained from traditional dissections into the clinical realm. However, the shortcoming of the radiology workshops is the minimal opportunity for practice in communicating observations and inferences. Although students discuss the cases within their small anatomy groups, this conversation is limited to identifying structures that are exemplified by the radiographic images. Even when the students comment on elements not included in the handouts, their discussions end with identification of the relevant structure. Radiographic images are limited in their level of detail and do not provide the opportunity for analyzing fine detail and compiling realistic scenarios that fine art provides its viewers.

In view of the fact that there is opportunity for instruction in both observational skills and communication skills, the museum workshop may be superior to both the radiology workshops and the workbook exercise. The incorporation of formal discussions into the radiology workshops and the workbook exercise could enable participants to extract more worth from these sessions, and thus increase their effectiveness. The workbook exercise was conducted in an independent study environment in an effort to determine whether the interactive component of the workshop at the YCBA was essential to its success.

Although the results of this study indicate that the interactive environment is not required for improvement in observational skills, it is likely that important communication skills are gained from the museum workshop. Therefore, it would be reasonable to restructure the workbook exercise such that participants would have equal opportunity for improvement in communication skills. For instance, the workbook could be applied in a





forum similar to that of the workshop at the YCBA. Students would be divided into groups of four and assigned a facilitator who is familiar with the exercise. Each student would then complete one section of the workbook independently. Subsequently, students would present their painting to the group using the structure of presentation that is characteristic of patient presentations. Group discussion would then follow each student's presentation. Using this format, medical schools without access to an art museum could incorporate fine arts into their curriculum in a manner that enhances both observational and communication skills.

The current emphasis that medical schools are placing on clinical reasoning skills provides an area of the curriculum in which the application of the visual arts, as described above, would be appropriate. The importance of teaching clinical reasoning to medical students is emphasized in a recent study published by Groves et al., which examines the process of clinical reasoning and its contribution to diagnostic performance at different levels of medical training (17). The purpose of this study was to identify the types of errors in clinical reasoning that occur at the level of second-year and fourth-year medical students, as well as general practitioners. The process of clinical reasoning is characterized by the following five steps: 1) identification of relevant clinical information; 2) interpretation of the meaning of this information; 3) creation of hypotheses that explain the problem at hand; 4) testing and adjustment of these hypotheses through data collection; and 5) production of a working hypothesis. Groves et al. focused their analysis on the first three steps of the clinical reasoning process, and utilized clinical reasoning problems (CRPs) of varying levels of difficulty as a means of



assessing steps 1-3. Interestingly, they found that identification and interpretation errors decreased with increasing problem difficulty, while hypothesis errors occurred more frequently. In an effort to explain this finding, Groves et al. propose that both medical students and general practitioners have difficulty separating relevant and irrelevant information when faced with more complex problems. Therefore, careful consideration is given to all of the information provided, with the result of fewer errors in identification and interpretation (17). For subjects at all levels of training, the complex patient presents a novel scenario and therefore forces the diagnostician to enhance his observational skills. The role of complicated patients in this exercise is not unlike the role of fine art in the workshop at the YCBA. Both represent unfamiliar territory for the participants and require unbiased interpretation. In this way, the museum workshop and the modified workbook exercise provide a complement to the use of CRPs as a means of educating medical students in the process of clinical reasoning.

The process of clinical reasoning is rooted in the process of critical thinking, which is essential to the foundation of the American education system. Students in the United States are taught not only to absorb, but also to analyze, new information. This ability to criticize and challenge is central to the success of physicians. It is the ability to think critically that continually enables physicians to push the boundaries of medicine.

Undeniably, the power of objective analysis is evident beyond the realm of medicine. Moreover, the role of the visual arts in teaching students to think critically deserves recognition in the general education curriculum as well as the undergraduate medical curriculum. In fact, Yurika Sammori, the Director of the Tsukuba Institute for Language



Arts and the creator of a course entitled “The Analysis of Picture,” has recognized the need for such an approach in her native country. This course, which is offered to children aged 5-12 years old, is designed to teach Japanese students how to think critically. The process of critical thinking is taught through picture analysis, with emphasis placed on careful observation and unprejudiced interpretation, similar to the workshop at the YCBA (Braverman, I.M. Personal Communication. 14 June 2002.).

By continuing to promote unique programs such as the observational skills workshop at the YCBA, Yale University School of Medicine remains at the forefront of an international movement to incorporate the visual arts into the educational curriculum. In so doing, Yale “might escape some of the inertia of tradition, and so become less categorical, less reductionistic, and more attuned to individual human qualities” (3). Such was the hope of Geri Berg in the 1970s, and such remains the goal of the creators of the workshop at the YCBA and the author of this thesis.



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Appendix A  
Examples of Paintings

**The Death of Chatterton**  
By Henry Wallis





**Mrs. James Guthrie**  
By Frederic Leighton





**The Gore Family with George, 3<sup>rd</sup> Earl Cowper**  
By Johann Zoffany



**Belshazzar's Feast**  
By John Martin







Appendix B  
Example of Workbook Section





Question 10

- What is a possible interpretation?
- The speaker is a doctor who is not a nurse
  - The speaker is a nurse who is not a doctor
  - The speaker is a doctor and a nurse
  - The speaker is a nurse and a doctor
- Correct answer: **The speaker is a nurse and a doctor**
- Explanation: The speaker is a nurse and a doctor. This is indicated by the use of the word "nurse" in the first sentence and "doctor" in the second sentence.
- Correct answer: **The speaker is a nurse and a doctor**
- Explanation: The speaker is a nurse and a doctor. This is indicated by the use of the word "nurse" in the first sentence and "doctor" in the second sentence.



### Required Activities to Complete:

1. Write a 1-2 page report of your findings. Be sure to include the following information:
  - a. A clear statement of the problem and the objectives of the study.
  - b. A description of the methods used to collect and analyze the data.
  - c. A clear statement of the results of the study.
  - d. A clear statement of the conclusions drawn from the study.
  - e. A clear statement of the implications of the study.
2. Prepare a 10-15 minute presentation of your findings to the class. Be sure to include the following information:
  - a. A clear statement of the problem and the objectives of the study.
  - b. A description of the methods used to collect and analyze the data.
  - c. A clear statement of the results of the study.
  - d. A clear statement of the conclusions drawn from the study.
  - e. A clear statement of the implications of the study.
3. Write a 1-2 page report of your findings. Be sure to include the following information:
  - a. A clear statement of the problem and the objectives of the study.
  - b. A description of the methods used to collect and analyze the data.
  - c. A clear statement of the results of the study.
  - d. A clear statement of the conclusions drawn from the study.
  - e. A clear statement of the implications of the study.
4. Prepare a 10-15 minute presentation of your findings to the class. Be sure to include the following information:
  - a. A clear statement of the problem and the objectives of the study.
  - b. A description of the methods used to collect and analyze the data.
  - c. A clear statement of the results of the study.
  - d. A clear statement of the conclusions drawn from the study.
  - e. A clear statement of the implications of the study.
5. Write a 1-2 page report of your findings. Be sure to include the following information:
  - a. A clear statement of the problem and the objectives of the study.
  - b. A description of the methods used to collect and analyze the data.
  - c. A clear statement of the results of the study.
  - d. A clear statement of the conclusions drawn from the study.
  - e. A clear statement of the implications of the study.
6. Prepare a 10-15 minute presentation of your findings to the class. Be sure to include the following information:
  - a. A clear statement of the problem and the objectives of the study.
  - b. A description of the methods used to collect and analyze the data.
  - c. A clear statement of the results of the study.
  - d. A clear statement of the conclusions drawn from the study.
  - e. A clear statement of the implications of the study.









Chomsky (1965)

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Chomsky (1965)

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Appendix C  
Workbook Painting Descriptions

*The Death of Chatterton*

This painting was completed by Henry Wallis in 1856. The painting depicts the young poet Thomas Chatterton, who took his own life at the age of seventeen. Thomas Chatterton was born in Bristol, England on November 20, 1752, three months after the death of his father, a poor schoolmaster. As a child, Chatterton made few friends and spent his free time reading books. At the age of ten, Chatterton began writing poetry. Despite the fact that neither his mother nor his sister appreciated his poetry, writing seemed to uplift Chatterton's temperament. The young poet used a collection of waste papers, which he had inherited from his father, for his writing. Included amidst these papers were some pieces of parchment paper from the nearby church of St. Mary Redcliffe. Perhaps it was this association with the church, in conjunction with the isolated nature of his life, that led Chatterton to construct a fictional author for his own poetry. Soon after Chatterton began writing, he began telling people that he had discovered the poems "in a chest in Redcliffe Church". Writing in the style and language of a fifteenth century poet, Chatterton accredited his own works to a fifteenth century priest named Thomas Rowley (1).

In July of 1767, Chatterton left Colston's Hospital and began an apprenticeship at the office of John Lambert, a Bristol attorney. It was during his time as an apprentice that Chatterton completed most of the Rowley poems. In the winter of 1768, Chatterton wrote first to James Dodsley and then to Horace Walpole attempting to sell his own



poems as authentic fifteenth century manuscripts. While Walpole initially displayed interest in the poems, Dodsley rejected them immediately. After receiving negative feedback from a colleague, Walpole, too, rejected the poems and deemed them inauthentic. Disappointed by this turn of events, Chatterton began writing for the *Town and Country Magazine* and other London journals. On April 14, 1770, Chatterton left a document on his desk, now referred to as *The Last Will and Testament*, in which he disclosed his intention of committing suicide. At the end of April, Chatterton left for London and attempted to make a living as a freelance journalist. Beaten down by poverty after four months of living in London, Chatterton committed suicide at the age of seventeen (1).

Following his death, it was eventually determined that the Rowley poems were written by Chatterton himself and thereafter he became a hero to the Romantic poets. As Robert Nye states in *The New York Times*:

For the Romantics, Chatterton embodied all their private, but mutual, fantasies of the character, or type, of the Poet: young, poor, alone, putting down the prosy with his genius and his cunning, yet decently defeated by the cruelty of life, misunderstood, proud, a failure, a suicide, and, by vulgar repute, a madman.

This adoration is depicted by one of many subsequent references to the poet, in Wordsworth's *Resolution and Independence* (1802):

I thought of Chatterton, the mar-  
vellous Boy.  
The sleepless Soul that perished  
in his pride.

At a time that was too late for Chatterton to appreciate, the young poet's talent and sacrifice were finally recognized and he became a model for English Romanticism (1).



### *Mrs. James Guthrie*

This painting was completed by Frederic Leighton sometime between October of 1864 and January of 1866 (2). The subject of the painting is Ellinor Stirling Guthrie, who was born in Perth, Australia in 1838. Ellinor's father, Admiral Sir James Stirling, was the first Governor of Western Australia. However, he returned to active service while Ellinor was an infant, eventually earning the title of Admiral. One of eleven children, Ellinor and her brothers and sisters were raised in Guilford, England and a variety of naval bases in the Mediterranean and the Far East (3). At the age of eighteen, Ellinor married James A. Guthrie, who was a successful banker and eventually became director of the Bank of England. Between the years 1857 and 1869, they had nine children together (2).

Leighton painted this portrait between the births of Mr. and Mrs. Guthrie's fifth and sixth daughters. During this time, sittings for the portrait were often postponed due to Mrs. Guthrie's poor state of health following the birth of her fifth daughter. In April of 1865, Mrs. Guthrie's father passed away, and it is possible that the black dress she wears in the painting is a reference to her state of mourning following his death (4). In addition to her black dress, Mrs. Guthrie's subdued expression and pale complexion also suggest a somber tone, reinforced further by the flowers sitting on the table, suspended somewhere between life and death (5). She is surrounded by ornately decorated furniture covered in silk fabric, but these riches are seemingly not enough to uplift her spirit. Adding to the intrigue of Mrs. Guthrie's story is the tapestry that hangs behind her in the painting. Faintly visible, this tapestry depicts a scene in which a woman moves toward a man who turns back to look at a child carrying a flaming torch. The scene is described as





mythological lovers and a cupid and is believed to illustrate a world that Mrs. Guthrie was forbidden to express due to the circumstances of her life and the characteristics of the society that surrounded her (6).

Four years after the birth of their youngest child, James Guthrie passed away, leaving Ellinor with nine children and a large fortune (3). Interestingly, Ellinor married James' cousin, Forster F. Arbuthnot, six years later. Arbuthnot was a retired Indian Civil Servant and held a strong interest in Oriental philosophy and literature. Indeed, he played a role in publishing the translation of *The Kama Sutra* and other Indian texts on eroticism (2). Perhaps in her marriage to Arbuthnot, Ellinor finally discovered a means of expressing her hidden passions, so long subdued during her marriage to James Guthrie (6).

### ***The Gore Family with George, 3<sup>rd</sup> Earl Cowper***

This conversation piece was painted by Johann Zoffany circa 1775. Completed just before the marriage of Hannah Anne Gore to Lord Cowper, the painting depicts the Gore Family with Lord Cowper in his villa overlooking the hills of Fiesole in Italy (3). Lord Cowper first visited Italy from England in 1759, soon after inheriting a large fortune. He eventually relocated to Florence permanently, where he played an active role in Florentine society. Lord Cowper's contributions included a collection of pictures by Renaissance and seventeenth-century masters as well as the use of five rooms in his house for scientific experimentation (7). The Gore Family moved from England to Florence in 1773, seeking milder climates on account of Mrs. Gore's poor state of health (3). Soon after the arrival of the Gore Family in Florence, Hannah, the youngest of the



three Gore daughters, won Lord Cowper's affection. By the age of sixteen, Hannah was married to Lord Cowper. Lord and Lady Cowper became prominent members of Florentine society and their generous hospitality was sought after by many in Florence, including the English in particular (7).

Zoffany's portrait was completed just before the marriage of Lord and Lady Cowper, which took place on June 2, 1775. According to Ellen D'Oench, "it may be viewed on several levels as a commentary on the past, present, and future of his sitters" (8). In the painting, Hannah's mother is seated on the far right holding a book, alongside one of Hannah's elder sisters. Her father plays the violoncello alongside her other sister, who plays the piano. Resting on a chair next to the piano is a pile of colored pictures of ships, representing Mr. Gore's amateur interest in painting nautical scenes. Finally, Lord Cowper and the soon-to-be Lady Cowper are the only two individuals who stand in the scene. Lord Cowper stares in the direction of his future wife, while Hannah appears to gaze past him, lost in her own thoughts. In addition, Hannah stands before a large allegorical painting depicting a marriage scene in the Temple of Hymen.

In this scene, a groom guides his reluctant bride to the altar while Hercules grasps the hair of Calumny as she attempts to run away. Iris, the messenger of the gods, and two cupids are seen flying overhead, and the River God and nymph, representing the Arno, reside in the lower right-hand corner (7). One explanation for the inclusion of this allegory in the portrait is that it alludes to gossip about Lord Cowper's past. More specifically, the painting may refer to Lord Cowper's obsession with and near marriage to



a Florentine woman, prior to his engagement to Hannah. According to this interpretation, the painting suggests that this gossip should end with the upcoming marriage of Lord Cowper and Hannah Gore (8). Another explanation considers all of the elements incorporated into the background painting, namely the woman holding a baby, the reluctant bride, the abusive man, and the seduction scene. It is possible that this painting is a representation of Hannah's fear of her upcoming marriage, and the problems that will accompany such a commitment. Perhaps the truth lies in both of these interpretations, with the background painting embodying not only the tainted past of Lord Cowper, but also the unspoken fears of Hannah Gore.

### *Belshazzar's Feast*

This painting, completed by John Martin in 1820, was displayed at the British Institution exhibition in 1821 and was awarded the prize for best picture of the year. The painting created such a spectacle that it had to be separated from the crowds by a railing and the exhibition was kept open three weeks longer than planned, to offer all interested viewers an opportunity to see this phenomenal work of art. With this painting alone, Martin achieved instant fame (9). Ironically, the idea for this painting did not come from Martin himself. It was Martin's friend and fellow artist Washington Allston who first resolved to paint the biblical scene described in Chapter V of the Book of Daniel. As described by Paley in *The Apocalyptic Sublime*, Martin explained in 1834:

[Allston] was himself going to paint the subject, and was explaining his ideas, which appeared to me altogether wrong; I was explaining my conception; he told me there was a prize poem at Cambridge, written by Mr. T.S. Hughes, which exactly tallied with my notions, and advised me to read it. I did so, and determined on painting the picture. (10)



Although Allston's large painting of *Belshazzar's Feast*, measuring twelve by seventeen feet, was never finished, two oil sketches of his plans for the scene were completed and are small paintings in and of themselves (10).

According to the biblical story, Belshazzar was a Babylonian King who held a great banquet "for a thousand lords", at which the guests drank from vessels stolen by Nebuchadnezzar from the Temple at Jerusalem. In the middle of the feast, the unrecognizable words "Mene, Mene, Tekel, Upharsin" appeared on the wall. Since neither Belshazzar nor his wise men could decipher the meaning of these words, the prophet Daniel was asked to interpret them, and he declared the following:

And this is the writing that was written, Mene, Mene, Tekel,  
Upharsin.  
This is the interpretation of the thing: *Mene*; God hath numbered thy kingdom, and finished it.  
*Tekel*; Thou art weighed in the balances, and art found wanting.  
*Peres*; Thy kingdom is divided and given to the Medes and the Persians.

Daniel 5:25-28

In *Belshazzar's Feast*, Martin depicts the climactic moment of this story, and places the prophet Daniel at the center of the painting. Reinforcing his importance to the story, Daniel's powerful stance is set against the timid and fearful guests who surround him. Included in Martin's depiction of the story are also the stolen vessels, shown on and in front of the table in the foreground (11).

In *Belshazzar's Feast*, Martin's experience as a painter of landscapes and historical scenes is evident. The architectural style of the palace derives from the three orders established at the time of the story of Belshazzar, around 558 B.C. These are the Indian, the Egyptian, and the Babylonian orders. In addition, the depiction of the moon, three





days old, with the planet Venus reflects precisely the time when the citizens of Babylon traditionally held their feasts (12). Taking into account the combination of historical accuracy, attention to detail, and splendor captured in *Belshazzar's Feast*, it is no surprise that this painting brought Martin such immediate recognition.

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Appendix D  
2003 Test Photographs and Grading Criteria

Photograph 1





Photograph 2A







**Photograph 2B**





**Photograph 2C**





**Photograph 3**





Photograph 4







**Photograph 5**



**Photograph 6**













**Appendix E**  
**2004 Test Photographs and Grading Criteria**

**Photograph 1**







**Photograph 2A**





**Photograph 2B**





**Photograph 2C**





Photograph 3





















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