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Digital Technology: The Modern Medium For The Art Classroom

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“DIGITAL TECHNOLOGY: THE MODERN MEDIUM FOR THE ART CLASSROOM”

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by

Linda Sue Al-Hanna

2013

DEDICATION

To my husband Nizar who has inspired us all with his love, determination, endurance and courage. To my children, Jaclyn, Jehan and Joseph, who motivated me to go back to school after so many years, telling me to “get hungry,” and to “shoot for the stars,” and “you can do it; just go for it.” To my Mom, who reminded me never to give up. To my twin, who has remained by my side after the first ‘ten minutes’ into this beautiful world. I thank all of my family and friends, for the love and support they always give me. And to my Dad who left us memories which will always inspire me in life.

“DIGITAL TECHNOLOGY: THE MODERN MEDIUM FOR THE ART CLASSROOM”

by

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ABSTRACT

Digital technology is an important tool teachers can utilize in the art classroom for the purposes of instruction, lesson planning and student interaction. The computer has been around for many years, and has been a key factor in globalization in the educational setting. More and more students are connecting with others around the world and learning with the computer in more diverse ways than ever. Digital art has been quickly expanding since ‘Sketchpad’ was developed in the late 1960’s by Ivan Sutherland. Students today have been born into a digital world and it has become imperative that teachers make the most out of any and all types of available technology.

Today art students can observe a procedure for a lesson given by a teacher from products such as a smart board, document camera, In-Focus, ELMO, i-Pad, and many other technologically advanced devices. Students are learning in ways that go far beyond the traditional. Research has proven computers and technology in the classroom positively benefit student learning. Analysis conducted by educators, professionals and theorists addressed in this paper will reveal both the pros and cons for the implementation of digital technology in the visual arts classroom. Data will reveal results from the various cited research and studies conducted by these professionals on the subject. The history, advances, and implementations of digital technology for the art classroom will be thoroughly documented and discussed.

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Chapter 1

INTRODUCTION

Today's children are born into a complex, digital, technological age. Students in the classroom today have been referred to as 'screenagers,' 'digital natives,' or 'digital kids.' Educators firmly believe that technology, such as interactive hypermedia¹ technologies, helps support the use of constructivist teaching methods in the art classroom. David Staley (2000), who is the principal of a consulting firm, executive director of the American Association for History and Computing, and History professor for the University of Maryland University College, states "a computer is a business tool; for a teacher, a computer is a library; for the researcher, the computer is an archive; and finally, for the artist, the computer is a canvas" (p. 2).

Today teachers have a responsibility to educate students using the best resources our educational system can offer. Educators need to help students in ways that best help them to learn and visualize problem solutions. Howard Gardner, who is not only an American developmental psychologist, at the John H. and Elisabeth A. Hobbs Professor of Cognition and Education at the Harvard Graduate School of Education at Harvard University, studied how people learn in a variety of ways, and as a result of his findings, introduced the world to his *Theory of Multiple Intelligences*. "It's not how smart you are, but how you are smart," according to Howard Gardner² (1983).

Howard Gardner's Theory of Multiple Intelligences states that not only do human beings have several different ways of learning and processing information, but these methods are

¹ Interactive hypermedia technologies was referred from the Partnership for 21st Century Skills. *Hypermedia* is a computer-based information retrieval system that enables a user to gain or provide access to texts, audio and video recordings, photographs, and computer graphics related to a particular subject.

² Howard Gardner wrote *Frames of Mind* in 1983, in which he outlines seven distinct intelligences, and later adds to his list of intelligences.

relatively independent of one another, which leads to the theory of multiple "intelligences" as opposed to a general intelligence factor among correlated abilities' (Gardner, 1983). Gardner identifies and describes eight intelligences in people. Some of the following examples will provide further detailed information.

The first intelligence is called Musical - Rhythmic & Harmonic which has to do with sensitivity to sounds, rhythms, tones, and music. People with a high musical intelligence normally have good pitch and may even have absolute pitch and are able to sing, play musical instruments, and compose music. Since there is a strong auditory component to this intelligence, those who are strongest in it may learn best via lecture. They will sometimes use songs or rhythms to learn, because they have sensitivity to rhythm, pitch, meter, tone, melody or timbre.

Wassily Kandinsky for example, learned music at a very early age, because he possessed the Musical – Rhythmic & Harmonic intelligence which Gardner describes. Later, Kandinsky became an artist, and created master pieces of art to paint images of musical instruments. Kandinsky is reported to have said that while playing a musical instrument such as a horn, he could see the color yellow; or while playing the violin, in his mind, could visualize the musical notes in the color blue. Kandinsky's artistic talents magnifies the Visual – Spatial intelligence. This is a good example of a person having multiple intelligences.

In a classroom project, an art teacher can play classical music, and introduce the artist Wassily Kandinsky using the National Gallery of Art with the interactive museum for students. The art lesson would be enhanced by the student's listening to digital music from the computer, as they create either traditional or digital art in the style of Kandinsky.

The second intelligence is called Visual – Spatial, an intelligence which deals with spatial judgment and the ability to visualize with the mind's eye. People with this intelligence, enjoy

reading and writing, are good at putting puzzles together, as well as being good at interpreting pictures, graphs and charts. In addition, people such as Kandinsky, who possess Visual – Spatial intelligence, enjoy drawing, painting and the visual arts. They can also recognize patterns easily. Artists, graphic designers, and teachers are a few other examples of the individual who possess the Visual – Spatial intelligence.

The third intelligence is called Verbal – Linguistic, in which people display a skillfulness with words and languages. They are typically good at reading, writing, telling stories and memorizing words along with dates. Having art student keep an art journal where they could write their thoughts about an art lesson each day, would enhance this intelligence. The art teacher can also integrate reading as well as science into an art lesson by first reading a non-fiction book about Sea Turtles to their students. The students will learn scientific facts about the sea creature and its environment. Second, the students will draw a picture of a sea turtle, and color the image using color pastels. Finally, the student will paint using water color paint over the color pastel image; this is a technique called a ‘water color resist.’

The fourth intelligence is called Logical – Mathematical, which is an area having to do with logic, abstractions, reasoning, numbers and critical thinking. There are many art lessons in which the art teacher can implement math into an art project. For instance, geometric shapes can be taught by the art teacher using the smart board. The instructor can divide the smart board screen into four quadrants which provides the opportunity to have four students practice drawing shapes using the smart board pen or they can choose to transfer a geometric shape from the smart board’s tool bar into their quadrant. The smart board allows the students’ the choice of color as well, using the smart board’s color palette which is also located on the tool bar. Students enjoy using this type of technology, because they can experiment with a multitude of choices, and

designs, and can share their ideas or add to one's ideas by interacting with each other in the activity.

The fifth intelligence which Gardner reveals is called Bodily – Kinesthetic, the core elements for which there is an ability to control one's bodily motions and the capacity to handle objects skillfully. Gardner elaborates to say that this also includes a sense of timing, a clear sense of the goal of a physical action, along with the ability to train responses. People who possess this intelligence are athletes, coaches, or dance performers, for example. An artist can be an example as well, because they handle objects skillfully such as a paint brush, or when artistically sculpting clay using tools or using their hands for instance.

The sixth intelligence is called Interpersonal, which applies to the interaction with others. In theory, individuals who have high interpersonal intelligence are characterized by their sensitivity to others' moods, feelings, temperaments and motivations, and their ability to cooperate in order to work as part of a group. Having an art group project where students paint a mural together can reinforce and enhance this intelligence. The art teacher can help foster the interpersonal intelligence by having each student critique³ their fellow student's art work. By allowing the students to discuss their opinion about another's art, provides interaction with others. The student learns about another's motivation and or feelings about their art work. Critiquing is an important component in the student learning experience in the art setting. The teacher can plan a field trip to the art museum, or allow the students to enjoy an interactive field trip via the internet museums on the computer, located in the classroom. Either of these activities, promotes the opportunity for group discussion or critiquing. Students learn how to ask questions about art, while improving critical thinking skills.

³ Critique or art criticism is the discussion or evaluation of visual art.

The seventh intelligence is called Intrapersonal, an area that has to do with introspective and self-reflective capacities. This refers to having a deep understanding of the self; what one's strengths or weaknesses are, and being able to predict one's own reactions and or emotions.

The eighth intelligence is called Naturalistic, the area that has to do with nurturing and relating information to one's natural surroundings. Examples include classifying natural forms such as animal and plant species and rocks and mountain types. Some proponents of multiple intelligence theory proposed 'spiritual' or religious 'intelligence' as a possible additional type. However, Gardner did not want to commit to a spiritual intelligence, but suggested that an "existential" intelligence may be a useful construct. The artist Georgia O'Keeffe can be referred to as a person who possessed the Naturalistic intelligence, because of her drawings and paintings of rock forms, and flower blossoms. The art teacher can enhance this this intelligence by allowing their students to draw sketches of plant life outside the classroom such as a tree, or an entire natural landscape for example.

Over the years, most educators have come to agree with Gardner's Theory of Multiple Intelligences. And as a result, the several intelligences which Gardner revealed, directs educators in the need to appeal to those varieties of learning styles. The art teacher has the upmost power to enhance these intelligences through the production of art making which will allow students to learn the applications of technology and constructive interaction with others. Students can learn visually, while others learn better orally. Others are tactile learners, while some are logical-mathematical. Technology is an important tool for learning for the variety of learning styles Gardner studied. Staley (2000) suggests, "because digital technologies can provide access to sounds, images, moving pictures, colors, and text, they appear to be the more ideal type of tools for the cognitively diverse classroom" (p. 3).

Digital technology used in the art classroom has changed the traditional way of learning visual art. Christiane Paul (2008), author of *Digital Art*, reveals digital technologies and interactive media have challenged traditional notions of the artwork, audience, and artist. Paul (2008) states, “The creation process of digital art itself frequently relies on complex collaborations between an artist and a team of programmers, engineers, scientists, and designers (p. 27). Digital art has combined its work with art, science, technology and design. Today the importance of technology is paramount when it comes to children and their future careers, because technology will prove to be a necessity in the job market of the future.

Researchers agree that implementing technology in the classrooms can be a vital tool in student participation and learning. By the same token, the art teacher must also defend the importance of physical interaction with hands on learning to be an essential part of the curriculum, such as using clay, sculpting tools, finger painting, charcoal drawing, collaging with textures etc. Educators do not want for students to be disengaged in the community of the classroom, nor for teachers to ignore valuable technologies in their use of instruction. Teaching must be a balanced pedagogy for the many different learning styles of students.

Chapter 2

HISTORY

Digital art has been influenced by science and technology. When we think about it, computers have been a direct result of research and in academic environments. Universities and learning centers produce many forms of digital art each year. However, the history of digital technology began during the 1940's.

In the 1940's the science of 'cybernetics'⁴ was born when Norbert Wiener's theories formed the basis for an understanding of the so called man-machine symbiosis, a concept which was later explored by a number of digital artists (Paul, 2008). The beginnings of new technology was spreading and becoming the popular venue to explore for the inventors in the world.

According to Paul, in 1945 "Vannevar Bush published an article describing a device called the Memex, which was a desk with translucent screens that would allow users to browse documents and create their own trail through a body of documentation" (p. 27). Even though the Memex was never built, it was the first conceptual idea to the electronically linked materials, the internet as the world's largest globally linked database. Subsequently, in 1946, the world's first digital computer was introduced at the University of Pennsylvania, called the Electronic Numerical Integrator and Computer (ENIAC). Technology kept advancing, and in 1951 the first commercial digital computer called the UNIVAC, which was capable of processing numerical as well as textual data, was produced (Paul, 2008).

In the 1960s, Theodor Nelson (1974) created the words, 'hypertext' and 'hypermedia' for a space of reading and writing in which texts, sounds, and images could be electronically interconnected and linked by anyone contributing to a networked 'docu-verse.' There began the

⁴ Cybernetics is from the Greek term *kybernetes*, meaning 'governor' or 'steersman,' a term Norbert Wiener (1894-1964) coined for the comparative study of different communication and control systems, such as the computer and the human brain..

understanding of the possibilities to transfer files and messages would result in the Internet as we know it today. According to Mark Hall (2013), in 1968, the information space and ‘interface’ idea expanded quickly when Douglas Engelbart and Ivan Sutherland from the Stanford Research Institute introduced the ideas of bitmapping, windows, and direct manipulation through a mouse⁵ (2013). Engelbart won the 1997 A.M. Turing Award, the highest honor in computer science, for his “inspiring vision of the future of interactive computing and the invention of key technologies to help realize this vision,” claims Hall (2013, p. 1). At the Stanford Research Institute (SRI), Engelbart and a colleague William English at Stanford Research Institute (SRI), eventually finalized a variety of input devices including joysticks, light pens, and track balls all of which are now common (2013). Teachers today are using light pens with the interactive smart boards.

In the 1970’s, this concept and related ideas were developed further by a team of researchers including Alan Kay, who is known for his work on the object-oriented programming and windowing the interface of the computer monitor at Xerox PARC in Palo Alto, California, and with the ingenuity of Steve Jobs, created the Graphic User Interface (GUI). They created the ‘desktop,’ which became known to the world as the Apple Macintosh computer. Inventions and computer products led to the beginning of a global communication network.

The World Wide Web was developed in the 1990’s by scientist and inventor Lee Berners. The Nielson online company who investigates consumers in more than 100 countries, placed their findings on the Internet World Stats web site, that in June 2012, more than 2.4 billion people, over a third of the world's human population, have used the services of the Internet, with approximately 100 times more people in 2012 than in 1995. Currently, according to the Internet

⁵ The mouse was conceived by the computer scientist Douglas Engelbart, developed by Xerox PARC, and made marketable by Apple. It is a pointing device that functions by detecting two-dimensional motion relative to its supporting surface. The mouse's motion typically translates into the motion of a pointer on a display, which allows for fine control of a graphical user interface.

World Stats (2012), the Indexed Web contains at least 2.83 billion web pages (Sunday, 03 November, 2013). In addition, the computer has virtually connected people with digital technology through the processes of art making. For example, Duchamp's work has been influential in the concept and practices of digital art. The shift from object to concept is a part of many of his works since the virtual object as a structure became known. Duchamp's ready-mades⁶ connect with the incorporation of 'found'⁷ or copied images that play a dominant role in many digital artworks. Artists today must be cautious when copying images to incorporate them with their own ideas for a newly created digital art because of copyright laws.

As early as the 1960's, art has been created by the use of the computer. For example, Michael Noll (2011), who was a researcher at Bell Laboratories in New Jersey, created some of the earliest computer generated images, which were exhibited in the 'Computer-Generated Pictures' at the Howard Wise Gallery, New York city in 1965. Since the 1960's through present day, the works of Charles Csuri, Vera Molnar and John Whitney are still influential for their investigations of computer generated transformations of visuals through mathematical functions.

In the 1960s, Billy Kluver collaborated with famed artists such as Robert Rauschenberg, Jean Tinguely, John Cage, and Andy Warhol. Ten years later, Kluver led the Experiments in the Art and Technology (EAT) team to design the Pepsi Pavilion at Expo in Osaka, Japan, which was a high technical based art installation, as reported by David Pescovitz (2004). Experiments in Art and Technology was a multifaceted collaboration between the artists, engineers,

⁶ Ready-mades of Marcel Duchamp are ordinary manufactured objects that the artist selected and modified, as an antidote to what he called "retinal art." By simply choosing the object (or objects) and repositioning or joining, titling and signing it, the object became art. As the process involved the least amount of interaction between artist and art, it represented the most extreme form of minimalism up to that time

⁷ Found objects refers to art which has been created from undisguised, but often modified, objects or products that are not normally considered art, often because they already have a non-art function.

researchers, programmers and scientists which would eventually become a characteristic of what digital art is today.

In 1968, the exhibition ‘Cybernetic Serendipity’⁸ was shown at the Institute of Contemporary Arts in London and set in motion a new way of creating art. Cybernetic Serendipity was an exhibition ranging from plotter graphics to light and sound environments and sensing robots. This exhibit challenged the artist to create digital art. Traditional practices continue, but artists of today are being challenged in the way they make art because new technologies are evolving or replaced each day.

For example, in the 1970’s, new technology such as video and satellites were introduced. This allowed for artists to experiment with live performances, and streaming media.⁹ Today, Internet television is a common form of streamed media. Teachers today can incorporate a lesson that is video streamed via a school network and connect with another school, to have a class to class communication and shared instruction. As an educator, having the opportunity to witness this type of technology use, has motivated me further to implement technology in my art classroom.

Not only has digital art evolved into various types of design and processes in which art can be created, other fields such as science, medicine, and education, are also evolving in research, development and design through the use of technology. Internet users now see the world differently. Our visual and auditory perceptions have been improved in the way we learn because of our exposure to the multitude of information technology has provided. The visual art

⁸ Cybernetic Serendipity is a term that today refers to systems of communication and control in complex electronic devices like computers, which have very definite similarities with the processes of communication and control in the human nervous system.

⁹ Streaming media is multimedia that is constantly received by and presented to an end-user while being delivered by a provider.

teacher offers a great opportunity to implement digital technology as a modern medium to advance student's perceptions and increase their learning capabilities.

Chapter 3

DIGITAL MEDIUM

When educators think of digital technology, they begin to realize it is intermingled in every aspect of our daily lives. Our ideas of art are changing because of interactive software and learning web sites, for the making and interacting of digital art, which are available and expanding each day. Furthermore, art education is where digital technology has its power for societal change in the way that students can interpret core subjects. Students can now join others around the world and experience a global network sharing, viewing and interacting with many art forms.

“The digital medium’s distinguishing features certainly constitute a distinct form of aesthetics: it is interactive¹⁰, participatory, dynamic, and customizable, to name just a few of its key characteristics” (Paul, 2008, p. 28). There are adjustments to be made in the art class for teachers to make when implementing digital art projects. Digital technology presents a new set of terminology in which teachers must now define meaning. For example, in design elements, a point is the invisible location where gridlines cross in computer art. A line in an oil painting is different from a digital vector line which can be moved, scaled, rotated, or copied as a unit. In addition, depending on the computer program, lines may be connected, bit-mapped pixels or vector segments. In computer art, pattern is usually referred to as area-fill or texture maps.

Interpretation, therefore, needs to be addressed in order for the teacher to utilize the modern terminology for digital art. Using only one art criticism model to critique, perceive and discuss art using universal art terms is a technique of the past. To use technology, is to use a nonlinear structure or diagram, such as in the use of Hypermedia programs, which develop

¹⁰ The term interactive is relying on a complex interplay between contexts and productions of meaning at the recipient’s end.

critical thinking skills in the contemporary student. This type of online program “enhances one’s ability to examine the richness of distinct data, to discover relationships, to synthesize ideas to form new understandings, to imagine new possibilities by transforming existing images, and especially, to recognize the plausibility of more than one correct answer or response,” (Keifer-Boyd, 1996, p. 33). Hypermedia programs are the modern way for critiquing art work because it allows the viewer many ways to interpret art. Critiquing is an important part of the art curriculum, and can be used as an assessment after students learn how to interpret traditional or digital art forms.

In the critiquing of the traditional art forms, the questions are directed to the mediums such as actual paint, clay, and charcoal for example. These created forms may have actual texture or actual three dimensional shapes in which the viewer uses additional bodily senses, where they may touch or walk around to see all sides of an art work for example.

On the other hand the critiquing of digital art uses terminology which is different from the traditional mediums. The viewer may discuss the pixels which is computer generated paint to show color or degrees of hues. They may also ask which tool in the tool box they chose to create the forms in the image. The tool box is not a metal box with hammers or wrenches, but an interactive tool box which contains electronic pens, paint brushes or erasers as examples. Another difference, is that digital art image created on the computer will have to be printed, if the artist wants to have a hard copy, which becomes a two dimensional art piece. The critiquing process is an important part in the student’s development of understanding and discussing art and will be challenging for the visual arts teacher because the terminology for digital art is still being developed. As time goes on, perhaps the visual art educators will be the creators of the new

terminologies for digital art, and as some researchers in technology agree, perhaps scientists will join in this magnitude of word discovery.

Digital media is any type of information in a digitalized format which includes computer-generated graphics, text, sound, and video, animations, or photographs. Included in these are digital audio, digital video, film, TV, or any digital produced content.¹¹ Bolter & Gromala (2003) suggest, “Designers and companies have arranged a union for all various underlying technologies come together to form new devices and interfaces” (p. 22). Technology can be complicated to educators who have not had the proper training. But how will educators use this technology in the art classroom specifically?

Vygotsky and Kozulin (1986) also believes the argument made by Paul that technologies often tend to develop faster than educators can keep up with, while the process of developing the descriptions and terminology for digital art, as a medium are produced. The digital medium is ultimately created by the viewer of the computer screen. The art can result in complex visuals to very abstract communication processes, and others predominately visual. (Paul, 2008).

In digital art, there are many types of art application and installations, some of which are film, video and animation, Internet art, software art, virtual reality and musical environments (Paul, 2008). “Installations come in various sizes and forms, and many are directed to creating environments which can strive to envelop the audience in a projected space to those that immerse them in a virtual world” (p. 139). “Digital installations sometimes incorporate a special and architectonic element which is usually the focus of the piece” (Paul, 2008).

¹¹ Digital means a method of storing, processing, and transmitting information through the use of distinct electronic or optical or optical pulses that represent the binary digits 0 and 1. Digital transmission/switching technologies employ a sequence of discrete, distinct pulses to represent information, as opposed to the continuously variable analog signal. Because digital signals are made up only of binary streams, less information is needed to transmit a message.

There are networked model installations where users are allowed to participate remotely in the work with large scale digital environments. These environments feature the physical object receiving an input and the result is the virtual object as the corresponding output. Can you imagine the possibilities of this concept for the art teacher? This is a remarkable opportunity for an art class to be present and participate in the process of an art installation such as this. A field trip to a museum which exhibits this type of art installation would provide a valuable learning experience for the art students. But many times field trips outside the classroom are not feasible, or museums may not have such installations to offer students in their communities. Another option the visual art teacher has, is allowing the art class to experience a virtual field trip on the class's computer.

Another example of an interactive art installation, is *The World Generator/The Engine of Desire*, created in 1995 by Bill Seaman and Gideon May. *The World Generator* is an interactive, computer mediated environment which enables the viewers to construct and navigate worlds in real time, based on an interactive template of potential choices, according to Alan Liu (2006). At the bottom of the screen, is a rotating set of container wheels for the various selections the viewer may use. One mode allows the viewer to observe a full screen blow-up of this menu. Liu (2006) reported the menu system contains the following set of container wheels:

Three dimensional models; poetic text fragments; texture maps – both still and video;
location sensitive

audio objects (musical loops); behaviors; and function menus which enable the viewer to center themselves in the world; to scale objects and texture maps; to make objects and texture maps transparent; to construct random worlds; to make a series of different “random” choices including random text, random sound, random object, random texture

map, random movie, random world, random behaviors; as well as to clear the world (p. 9).

This interactive installation can have two users at the same time, or people may visit this installation via the internet, states Liu (2006). For the visual arts teacher, this installation would be an excellent choice. Students can observe, participate in the interactive process, and then write about their experiences at the museum. In addition, the students may draw images of what they created, or witnessed from their fellow classmate's virtual world.

Another art installation which deals with the virtual and physical space is the *Timetable* (1999) by Perry Hoberman, which consists of twelve dial functions which can change and mutate, and can become clocks, gauges, speedometers, switches, steering wheels, etc., depending on what is projected onto them at any given moment. The three dimensional scene at the center of the table is controlled and influenced by the movements of the dials, which allows the *Timetable* to constantly be transforming as it is used. The interactive environment in such installations are remarkable for the visitors because they can interact and create in a way that is surreal.



3.1: *Timetable*, Perry Hoberman, 1999.

Another exciting field trip where the visual arts teacher may provide a learning experience for students, is to visit the installation such as *A Volve* (1994-1995) by Australian artist Christa Sommerer and Frenchman Laurent Mignonneau. The *A-Volve* installation provides the viewer the ability to produce artificial life, showing evolution, and gene manipulation. According to Timothy Binkley (1995), “on a touchscreen, visitors sketch the outlines and cross-sections of creatures;” afterwards, with a high-resolution projector, these visual beings are projected onto a mirror positioned at the bottom of a water-filled basin” (Binkley, 1995, p. 333). Binkley explains, “Through the real time calculations of a SGI¹² computer, the automatically-animated beings in luminous water assume an appearance, and their enhanced plasticity makes

¹² Silicon Graphics, Inc. (later rebranded SGI, historically known as Silicon Graphics Computer Systems or SGCS) was an American manufacturer of high-performance computing solutions, including computer hardware and software. Founded in 1982 by Jim Clark, its initial market was 3D graphics display terminals, but its products, strategies and market positions evolved significantly over time, and in the 90’s, the rights were sold to another entity.

them appear to be alive” (1995, p. 334). After, the viewer and creator, can enjoy watching their virtual life assembled about the pool, the creatures’ makers can observe the survival of their amorphous creation, thriving in their water environment.



3.2: A-Volve, Christa Sommerer and Laurent Mignonneau, 1994-1995.

Digital art can also impact the student’s imagination by viewing other artists’ or student art work who have created digital art. For example, an astronomy student named Alex Parker, took one of the most famous paintings in the history of art, which was Van Gogh’s 1889 *Starry Night*, and transformed a digital copy of the original work with 100 of the most famous space photographs taken from NASA’s Hubble telescope, to create his own masterpiece. His created



3.3: *A Hubble Deep Zoom*: Alex Parker (2012), a post-doctoral fellow at the Harvard-Smithsonian Center for Astrophysics, created a mosaic of *Starry Night* using 100 Hubble photos. He downloaded the photos from the European Space Agency's website, popped them into a free digital art software package called Andrea Mosaic and, voila, produced the image above.

version is entitled, *A Hubble Deep Zoom* (2012). “Parker used computer mosaic-making software to re-produce the artwork, after cloudy weather stopped him exploring asteroids and planets at the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts,” as reported by Eddie Wrenn (2012).

Art installations and digitally created art are part of today's visual art world and should be part of all art students' experience in the future. Educators must utilize technology in the classroom, and art educators must be supported in their efforts to educate their students in the processes of the digital medium in the technologically enriched visual art classroom. This effort will require significant input and support from parents, administrators, the business world, school districts, and local and national governments to be realized.

Chapter 4

IMPLEMENTATION IN THE ART CLASSROOM

The complexity of digital art has many traditional art educators feeling inexperienced because of the ever changing technologies and lack of training associated with the making of digital art. The majority of Art educators today are usually self-taught, when introducing digital art as a medium in the art classroom. Preparation and training in the use of technology, such as a Smart Board or Photoshop software as examples, are limited or non-existent, because most art classrooms are not equipped with a smart board or worse, a minimum of computers needed to introduce this technology to their students.

After the art classroom is provided the necessary equipment and after the teacher has had the necessary training, next would be how to implement digital art in the art classroom. There are so many ways in which art teachers can introduce technology to their students for the digital experience in creating art. For example, having an art class involved in the process such as in a collaborated work of art such as a virtual installation, is a modern project and a new frontier where teachers can explore with their students in today's technological based society. "A principle goal for arts education is for students to acquire relevant knowledge of themselves and their worlds, past, present and future, that comes from critically studied and personally created works of art," as quoted by Brent Wilson (Taylor & Carpenter, 2007). The important questions arise for the art teacher, when they begin this voyage of digital art in the classroom. How do art teachers implement this new medium? What type of technology, such as software, equipment or websites should be used?

The following guidelines for implementing digital art in the classroom, have been developed by Pamela Taylor and Stephen Carpenter, II (2007):

1. Students need guidance to develop critical viewing practices of digital media. This is not only in the form of questions we pose, but also in the choices we as teachers make in what we present for study and contemplation in the classroom. First, the teacher must supply a list of websites for student use, and maintain a record of time and place of access each student uses. Each student will keep a sign in log sheet which lists the websites visited, time spent, and student's notes, questions, and opinions about the sources or references for the information which was retrieved, for instance. The log sheet should include notes about the art viewed online, using the Edmund B. Feldman's Model (1967) for their critical viewing practices of digital art detailed as follows:

The four stages of art criticism are:

- * Description - listing what an art object seems to include
- * Formal Analysis - describing the relationship among the things that were listed
- * Interpretation - deciding what all your earlier observation means
- * Judgement - deciding the value of an art object

2. The incorporation of digital media in the study of art should be ongoing and relevant to the established curriculum rather than an add-on or a separate unit of instruction within the larger subject or school curriculum. At the same time, digital technology should be used to expand and disrupt the course of study in the art class. The visual art teacher must apply traditional art practices using the hands on art creating as well as the computer generated art forms.
3. The questions and choices teachers and curriculum designers ask and make should relate more to digital images, experiences, forms of communication, and uses that students use every day rather than the narrow and often awkward instructional procedures and

presentation methods teachers struggle to master periodically at school. The visual art teacher must allow for the student to take over their learning and decision making with teacher support; student to student teaching, as well as teacher to student instruction.

4. Art educators¹³ need to recognize that digital designers take into account the technological, historical, cultural, and economic dimensions of digital media and therefore we should understand: a) the relationship to earlier media forms; b) the multiplicity of digital media forms; c) the importance of the cultural and economic contexts in which a given medium will function; d) how digital technologies seek to embody the virtual; and e) that digital media can both pose cultural questions and suggest solutions.

The art teacher can connect the importance of the digital designers who create the interactive games they play on their smart phones and iPads, each day such as *Angry Birds*, or *Pac-Man*, as examples, or the global connections they are able to experience while taking virtual tours in museums around the world learning other cultures and societies. They can create Aboriginal art using examples from the online digital art collections by Aboriginal artists for example.

Gregory, Taylor and Carpenter (2009), noted that “hypermedia learning can help students ‘uncover’ various levels of meaning while creating works of art to facilitate an approach to art learning that involves, explanation, interpretation, application, perspective, empathy, and self-knowledge.” However, in order to implement digital art as a modern medium in the visual art classroom, the art teacher needs to assemble the proper materials and equipment and consider the legal concerns associated with internet usages.

1. ¹³ Taylor and Carpenter refers to visual Art Educators: Bolter & Gromala (2003, 148-158).

4.1 Software

The software available for today's classes include PowerPoint Inspiration, Keynote, Story Space, Tinderbox, iTunes, iMovie, iPhoto, iDVD, Garage Band, Image Capture, and Podcast Capture. Other software include Photoshop, Audacity, and Microsoft Word. For the internet, browsers such as Firefox and Safari are good choices to have for internet access. Some of these are free pre-installed multi-media software packages for any activity on Macintosh computers, and for the PC. Apple retail stores offer free face-to-face classes and customer support. In addition, Apple.com has K-12 instructional resources available for teachers. Many schools have a supply budget which allow the instructors to order many of the software listed. However, some schools do not have the adequate funding, and can only rely on traditional art supplies and materials, such as paper, pencils, crayons, and paint to list a few. Equipment is another resource needed for the art classroom.

4.2 Equipment

Equipment for the classroom should consist of digital flatbed color scanners, digital video cameras, and digital MP3 audio recorders with headsets and built in microphones, laser color printer with wireless network capabilities and flash or jump drives. Finally, the teacher and students need computers. The ideal number of computers in the art classroom, should accommodate each student with one, but a minimum of ten computers would suffice, but would still be inadequate because an entire class would not be able to create art at the same time. Once the art teacher has the needed software and equipment, the teacher must be aware of the recommended web sites ideal for students' use.

Although there are many web sites in which art teachers and students may choose to access, the teacher must be cautious when using these web sites for active student participation.

The teacher must determine which web sites are appropriate for their students' use. Another issue to consider is privacy and copyright laws when accessing or using information. The digital age has opened up many concerns in the educational arena that might lead to plagiarism and copying by students, both with images and words.

4.3 Law

The copyright law and the courts have provided exceptions to the rules which govern the behavior of teachers, students and schools. In general terms, teachers are allowed to make 'fair use' of materials for instructional purposes. Fair use has been interpreted to include those limited uses, which are not likely to deprive a publisher or an author from income. A teacher might make a copy of an article or a page from a book for their students to use as a support for a particular concept, but they may not make copies of the whole book or workbook for the entire class, and use the copies as class texts. They are expected to buy them if they are used in such a way.

Most educators today have created web sites for students to view student art work and documents and are using the internet to access clip art to also display on these created web pages. Many schools have purchased clip art collections to be shipped to the classroom for their use and for student use. But how this art may be used, is defined by the licensing agreement which accompanies the clip art product upon arrival. In most cases, the agreement is printed on some kind of seal which is broken upon opening the shipped package. In order to determine whether or not the user is permitted to publish the clip art images on a Web site, for example, there are guidelines to follow before publishing. In most cases there will not be specific language outlining Web rights, and as a result, the best advice is to read the agreement. Caution must be used by the person or people accessing material from the internet, unless there is a clear statement that art, photos and text are 'public domain' and are available for free use, the best

policy is to assume that they are copyrighted, and therefore should not be taken and used for re-publication on a local area network, or a Web site.

Student work is intellectual property and deserves protection against piracy as much as adult work. Many school districts have decided to post copyright notices on the bottom of all such pages. Most schools are careful not to publish the full name of students for safety reasons. In those cases where a potential publisher wishes to contact a student and a family for permission to publish work, it is best to forward the request to the family and let them contact the publisher. At any rate, the administrator should designate a staff member in each school to keep an eye on the Web site and the legal issues, which may arise when, or if a school engages in global publishing.

4.4 Recommended Web Sites

The following are the top ten recommended web sites in 2013, according to Google, which are available for creating digital art (out of hundreds more):

1. Art Pad - A great painting site that records a picture while it's created to create a time lapse effect. This web site is an excellent site for the Elementary student of all grade levels because the tools are easy to use and the colors are vibrant and fun to experiment with.
2. Slimber - An excellent site for drawing & painting with some beautiful examples. Students who have had experience in using the smart board, will feel right at home using the tools in this web site, because they are similar to the tools offered on the interactive smart board, but adds the uses of gradients in color.
3. Bomomo - A fun site where users can create unique pictures with different templates (i.e., Pixie). Using this web site, students can experiment with paint, creating art in the

style of Jackson Pollock, in the 'Doodle and Draw' page of Bomomo. The application provides the creator the effect they are dropping bits or splashes of paint in a variety of colors onto the screen (the screen being their canvas).

4. Doink - A great site for creating animated art with a Web 2.0 flare. However, the teacher must have access permission from their school district for the download and installation of this software.
5. Odosketch - A wonderful site for creating beautiful sketches with colored pencils. This web site allows for the student to see how color pencils can show layering of the many different colors this site contains for the creator.
6. Sketchpad - Create excellent paintings and drawings with this cool site. Many styles, effects and gradients for users to choose. The use of gradients is important because the student is able to see and understand there are different values in colors.
7. Sumo Paint - One of the most popular digital art creators on the web, very similar to Photoshop. When integrating shapes in an art lesson, this web site would help because the coloring applications allow for the two dimensional object to change in appearance through the coloring highlighter into a three dimensional object. The form then, allows the viewer to see space. Layering allow the creator to develop a creative style of art.
8. Live Brush - A wonderful free application that lets users create some beautiful designs. Includes a gallery of examples to view as well.
9. Crayola Digi-Color A very user friendly site for kids. This site allows the young student to practice coloring, and visualize the crayon's many effects, when adding more than one color. This will reinforce student learning of the primary colors in addition to the traditional applications, and reinforces their previous art

experiences of what happens when colors are mixed.

10. Voice Draw - A unique site that lets users create art with their voice/sound. This site is an incredible resource for the student with the fine motor skills disability.

When students are creating and discovering the many art mediums in the production of their art, teachers need to take full advantage of the many resources which are readily available for their students to explore. It is important that the visual art student be able to experiment in every medium possible, and be allowed to combine these mediums, which will allow for the student to produce unique art works.

In addition to the top ten web sites listed above, there are many more websites which are geared toward student learning and interactive use, one of which is Craig Roland's site which is an art education social and learning virtual network. The National Gallery of Arts Kids, is another excellent web site for student use in the classroom or home setting.

As an art educator, I have used the smart board in my classroom, because the school district where I teach, understands the importance of technology in the classroom, as well as in the art classroom. I have found the websites listed above to be excellent resources. Although my classroom lacks the needed student computers, this will not prevent student learning from the use of the smart board, interactive software or the use of one class computer. But it is clear from the studies conducted by educators, that the more technology is available and used for instruction and through student use, the more student success will be achieved.

Who is implementing digital technology in the art classroom today? The answer is not enough teachers. Only where there is state, district, and principal support, digital technology or any type of technology exists. Educators are confronted with different types of 'road blocks' when trying to implement technology in the classroom, and art educators are finding they are

separated from the teachers who teach the core curriculum, and are at times the last teachers who will receive support. Funding, training, lack of materials and space are the top on the list of road blocks. As an art educator, I have demanded to have the same type of technology in my art classroom as my fellow classroom teachers. The administration strives on an active basis to meet my technology needs as much as they can. I am thankful to have a principal who has been very supportive of my needs for the art classroom. My art students are proving they can create art in many and all forms. In the near future, I will provide instruction in the digital art processes to my students, which is a positive, modern and very exciting new frontier we will explore, experience and learn as a group together, teacher as facilitator, student as learner.

Chapter 5

DISCUSSION

In the art classroom, educators are finding a new form of language associated with the use of the computer generated art. Problems exist when the art teacher is discussing paint, when it is not real paint, but with which has been replicated from illuminated pixels, and has been created by a software program, instead of art being created using a real paint brush, using real oil paint, for example. The term paint, in an art classroom then could mean either pigment, or pixels¹⁴. The visual art teacher would explain the differences in the application and the visual effects between the physical paint versus the computer paint. There are other problems in the classroom where technology exists, such as the lack of proper equipment and materials. But the most important thing to remember using digital technology for the art classroom, is that the teacher must maintain the ‘cognitively diverse’ style of teaching. The teacher must focus on the multiple intelligences and individual learning styles their students have, by presenting multiple types of information in order to appeal to all types of learners. Technology enables students to produce a variety of informational products, and builds skills necessary for the world outside of school. “Imparting information to students is instruction; helping them to develop knowledge is education; technology is simply a tool that can support either function,” as quoted by Staley (2000, p. 3). There are many educators who have their doubts about the implementation of digital technology for the production of art.

David Staley (2000) warns, “Some professors have expressed the fear that once digital tools are permitted to over-run and eclipse the classroom space, the instructor will become redundant, which is a recipe for an unhealthy educational space” (p. 4). Staley (2000) reveals that

¹⁴ Pixel refers to the picture elements that make up each point on a display screen, which are controlled by the software program; pixels respond to the programming of pixels near them, thus creating shades of gray or different colors.

“active learning is not only allowing students to achieve a task other than listening to a lecture, even if they appear to be active, students may be entertained, but could quite possibly not be engaged in an active pedagogy.” The argument Staley (2000) makes, is that technology should be used in a classroom to encourage creativity and experimentation and not to only to keep students interested for the length of a class period. Staley (2000) defends the class whose teacher allows their students to be an active participant, through hands on creativity, and experimentation in the art classroom environment.

Pamela Taylor and Stephen Carpenter (2007), authors of *Mediating Art Education: Digital Kids, Art, and Technology*, suggest, “While life in a digital world might be natural for ‘digital kids,’ many of their teachers struggle to navigate the same digital landscape.” Carpenter and Taylor (2007) argue that more and more school districts enact reform measures to increase the use of digital technology in instruction and the curriculum, but in fact few teachers today, actually use the technology effectively or have a level of understanding and facility with it which is even adequate or meaningful to their instruction.

For example, as revealed by Taylor and Carpenter (2007), “in a survey with teachers in Virginia assessing twenty-three students in grades third through the fifth grade, to determine their familiarity with computer technology, most could use e-mail and were able to print documents” (p. 84) However, Taylor and Carpenter (2007) reveal, “few were comfortable in creating PDFs, transferring digital video and still images from digital cameras, or uploading files to a server” (p. 85). This sends a very strong message, that while having technology in the classroom is important, it becomes meaningless without the training and support for teachers to be able to implement these skills effectively in the classroom. Technology without ongoing teacher training and updating can become obsolete very quickly.

Another thing to consider is “Art Teachers typically use established computer technologies as teaching or presentation tools, rather than facilitating students’ creative production and thinking, collaborative learning, problem solving and higher order learning,” argues Diane Gregory (2009, p. 57). Student learning needs to be facilitated in a way where the student can take command of the creative process and discovery while using the technology as well as learning how to use technology from instruction. The argument today is not only how instructors will implement technology, but also must consider how to introduce the wealth of readily available information. Instructors need to prepare students how to handle the vast amount of information there is on the internet. Not only is the art teacher the instructor of art, they also become an instructor of computer literacy. What do our students know about computer use and how much do they need to learn? Each grade level needs to have an assessment of student’s computer skills. Guidance for students and teaching proper use is imperative in order to implement instruction that is pertinent, useful and timely.

Barriers occur when there is lack of funding, training, equipment or equipment failure, and as a result, teachers sometimes become discouraged and discontinue the use of the computer altogether. Financial support must be in place, and equipment must be maintained. Technical support is a vital source for a curriculum to have an adequate responsive learning environment. Teachers have the opportunity to become interactive along with their students and connect with communities, other schools, even other countries to exchange resources and ideas to help broaden student experiences in a technologically enhanced classroom, where education and the creation of masterpieces will flourish.

Chapter 6

EDUCATIONAL STUDIES

Today educators realize the benefits and unique possibilities in creating art on the computer as an art tool, and as a new medium in the art classroom. According to a report by the U.S. Department of Education in 2004 entitled, *Toward a New Golden Age in American Education*, “the nation’s schools are becoming more successful as they take computers out of labs and integrate them into the classrooms, providing students daily learning tools and student-centered learning environments,” argued by Diane C. Gregory (2009, p. 50). For example, when a school in the Chugach School District in Alaska did this, the reading scores from their students, rose from the 28th percentile to the 71st percentile in only four years; and their mathematics scores increased 54th to 78th percentile; and language arts scores increased from 26th percentile to 72nd percentile, as noted by Gregory (2009).

Other research revealed in 2001 according to Gregory, when the ‘eMints’ program enhancing Instructional Network Teaching strategies, was invited to help an Elementary school in Missouri, only 7% of third graders could read at grade level. Only after 200 hours of professional development designed to help teachers use multi-media learning technologies within student-centered learning frameworks, 80% of third graders were reading at grade level (2009). In fact, according to Gregory (2009), the study revealed 43,000 students and 3,000 teachers in 64 schools in Hendrick’s County, Virginia, were supplied with laptop computers. As a result, the students began using primary sources on the web, exploring different points of view of historical events, increasing interactions with teachers and other students, and taking virtual field trips to art galleries and museums (Gregory, 2009). The results were obviously dramatic. I have experienced such results in my art classroom, where student participation increased after we had

our first virtual museum tour. The student's eyes lit up in delight and after viewing the art, and the discussion we shared was heightened as a result of their new experience.

After the study in Chugach was conducted, "Virginia schools received the U.S. Senate Award for Continuing Excellence and nine U.S. Department of Education Blue Ribbon School awards" (Gregory, 2009, p. 53). Technology in these cases, has proven that technology in a student centered classroom improves student learning, increased motivation, along with teacher and student support. Another report Gregory cites is one by Milbrandt, Fets, Richards, & Abghari, who quoted, "students became more personally invested and empowered and even demonstrated higher levels of critical thinking in their remarks and interactions, when the internet and digital presentation technologies were introduced in a constructivist art classroom" (2009, p. 54). Gregory (2009) concluded that the reports suggest, "Where there is computer use as 'mind tools,' there lies the power to engage the student in art production, aesthetic inquiry, visual culture, and art criticism and art history" (p. 54).

Another project which introduces interactive digital technology to students is the *Skoolaborate* project which has been in existence with part of the virtual world called *Second Life*. Skoolaborate is an online virtual world developed by Linden Lab. It was launched on June 23, 2003. A number of free client programs, or Viewers, enable Second Life users to interact with each other through avatars (also called Residents). Residents can explore the world (known as the grid), meet other residents, socialize, participate in individual and group activities, and create and trade virtual property and services with one another. *Second Life* is intended for people ages sixteen and over, which is a great opportunity for high school students to interact between other high school aged students. Students learn how to create using the software online, which contains a three dimensional modeling tool, based on simple geometric shapes, which

allows residents to build virtual objects. There is also a procedural scripting language (Linden Scripting Language), which can be used to add interactivity to objects. Sculpted prims (sculpties), mesh, textures for clothing or other objects, animations, and gestures can be created by students, using external software and imported software onto the computer. This is why educators need to understand copyright laws for their students' use on the computer. The *Second Life* terms of service provide that users retain copyright for any content they create, and the server and client provide simple digital rights and management functions. In addition, *Second Life* features *Skoolaborate LITE* which is a global initiative using a combination of technologies including, blogs, online learning, wiki's¹⁵ and 'virtual worlds' to transform learning. This project encompasses many ways for the student to interact on the computer with others. The project aims to use these tools to provide engaging, collaborative learning experiences for students of ages between thirteen and eighteen years.

The projects created, integrate curriculum and digital technologies into collaborative global actions. In addition, the virtual learning space is secure and only accessible by invitation. Students from schools around the world are invited to participate. Initiated and managed by Westley Field at MLC School in Sydney, Skoolaborate now has over 40 schools and organizations from Australia, New Zealand, Taiwan, Japan, Singapore, Chile, Portugal, Canada, the UK and the USA. As a result, the project has used the initial experiences of students to gain the skills that allow Skoolaborate to work towards achieving the goal of improving educational outcomes for all students, particularly those who are disadvantaged. Imagine how this program could help disadvantaged students in the El Paso area. Educators have the opportunity to provide this program in the school's computer lab for example, for this interactive learning experience

¹⁵ A wiki is essentially a database for creating, browsing, and searching through information. A wiki allows non-linear, evolving, complex and networked text, argument and interaction.

for students who do not have computers in their home. Teachers can create multicultural lessons based on the interaction from students around the world.

Another study in which digital media is used in the art classroom which promotes student learning, was conducted by Dr. Stanley Madeja (1993) called the Illinois Project, which brought together 20 art teachers from ten K-12 public school districts for professional development in authentic assessment. The project was for art teachers to have digital art portfolios¹⁶ of their student's work. The study measured the effects of the digital alternative on classroom practices and on student learning. According to Madeja (1993), the teachers agreed to participate in a two year study that followed their digital portfolio journeys through interviews, focus groups, tape-recorded teacher journals, site visits, and surveys, and measured the effects on curriculum and assessment. "The participants came from five suburban schools including an elementary school in a newer middle income suburb and a middle school, urbanized of mixed demographics and a high school partially rural with mixed demographics, a high school in a middle income established suburb and a high school in affluent established suburb," stated Madeja (p. 10). The study revealed "participants noted the collection of student digital portfolios provided for easy development of benchmark learning exemplars, and evidence to demonstrate curricular connections to state and local goals, which helped to improve student learning" argued Madeja (p. 12). When students experience something new, the result from the learning processes they encounter, and the mastering of new concepts, while building new skills, gives students a sense of self confidence and victory. In the near future I plan to implement the use of digital portfolios in my sixth grade classes. Because of the allotted time for each class, I would be the person to take pictures of student art work. I would download the pictures in a class file, where each

¹⁶ Digital portfolio means any portfolio recorded in digital media and assembled in any format as an alternative to a collection of actual artworks.

student would be able to transfer their pictures from the class file to their flash drive. Then they would transfer their pictures to their online portfolio.

Studies are an important part in the development of utilizing digital technology applications for the art classroom. “Researchers have conducted studies which show positive indications of the impact art has on student developmental learning where drawing is an effective communicator for learning history for example, and contributes to the organization and persistence in writing” quoted by Dr. James Caterall (2009, p. 65) The training in visualization as a result, contributes to reading skills, and where reasoning of visual art seems to transfer to reasoning about science, according to Dr. James Caterall (2009). Not only are there educational studies in digital technology, there are also scientific studies which reveal how art can effect student learning.

Chapter 7

SCIENTIFIC STUDIES

Not only are there educational studies to back the need for digital art technologies for enhanced student learning, there are scientific studies as well. Patricia Rogers (1995), a doctoral candidate in both Art Education and Instructional Systems and Technology in the Department of Curriculum and Instruction at the University of Minnesota, refers to a quote by Lovejoy, 1992, “The computer is a universal tool whose digital alphabet code can be used indiscriminately to address image, text, or sound as information in its database” (p. 182). “Because the computer can be used in every field of endeavor, its use is providing connections between the arts and with science as well” (Rogers, 1995, p.182). Rogers explains that when it comes to computer based media, it is logical for the merging of science and technology to occur, along with an aesthetic awareness (1995).

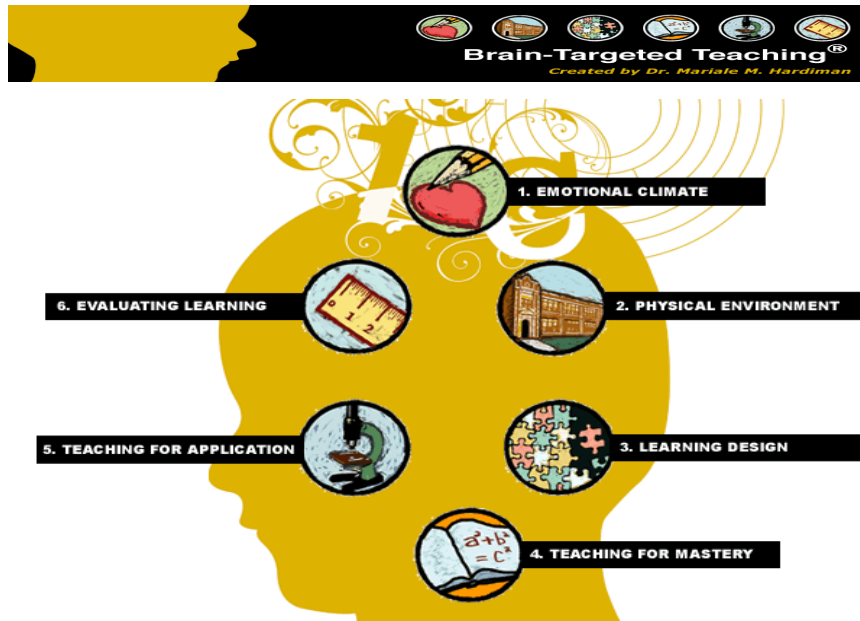
Our minds are evolving in ways that we are unaware of each day, due to technology and how we are seeing our world. For example, in the study of cognition, perception and the computer, author Willard Van De Bogart (1990) writes about Anthony Debons, who has developed the ‘Debonian Information Model,’ illustrates how the flow of data from the computer from our world and into our thinking processes, affects the way we communicate. Van De Bogart quotes Debons, stating “Where phenomenology is the study of human consciousness and meaning-making, information science is the study of how data is transformed into information as a result of the predominant mental template that is processing the data” (p. 319). Both our behavior as human beings and how we process incoming data are continuing transformations, because of three dimensional image making provided by the computer (Van De Bogart, 1990). De Bogart argues, although the computer cannot duplicate reality, it can process images of

reality in ways we have never seen before (1990). Core subjects are relying more and more on visual imagery for mapping, diagramming, three dimensional illustrating and more. This makes the role of the art teacher much more integral to student learning.

Another scientific research conducted by Mariale Hardiman (2011), called *The Brain-Targeted Teaching Model for 21st-Century Schools*, serves as a bridge between research and practice by providing a cohesive, proven, and usable model of effective instruction. Compatible with other professional development programs, this model shows how to apply relevant research from educational and cognitive neuroscience to classroom settings through a pedagogical framework.

Hardiman's (2011) model (Fig. 3.3) contains six components which are:

- (1) Establish the emotional connection to learning.
- (2) Develop the physical learning environment.
- (3) Design the learning experience.
- (4) Teach for the mastery of content, skills, and concepts.
- (5) Teach for the extension and application of knowledge.
- (6) Evaluate learning.



7.4: *Brain-Targeted Teaching*, Dr. Mariale M. Hardiman (2012)

Hardiman (2011), presents this model with the educator in mind and offers practical steps for using it to inform instruction while teaching the 21st century skills. Hardiman (2011) is dedicated to help the educator achieve improved outcomes for students and better collaborative professional practices in the school setting. The Brain-Targeted Teaching Model connects research based effective instruction with elements from the brain sciences to inform teaching and learning. Continuing her interest of bringing to educators relevant findings from the brain sciences, Hardiman (2011) collaborated with colleagues from across the University and community to develop the JHU School of Education's Neuro-Education Initiative, supported by the Johns Hopkins School of Medicine's Brain Science Institute. Researchers who were involved in the study are Michael Posner Ph.D., from Oregon, who supports the practicing in art influences cognition in general. Researcher Elizabeth Spelke, Ph.D., from Harvard, revealed that music properties can help enhance student's geometric skills (Hardiman, 2011). Researcher Brian Wandell Ph.D. revealed, 16% of the variance in children's reading scores can be explained

by the implementation of music training in those individuals (Hardiman, 2011). Dr. Wandell further revealed in this study, an unexpectedly strong correlation between the visual art experience and increased math skills (Hardiman, 2011). Currently, Hardiman's model is followed in most teacher's lesson plans.

The following is an example lesson plan which uses the Hardiman model:

Instructor: Mrs. Linda Al-Hanna

DATE: 8/5/13-8/9/13

TITLE: Portfolio Design

LEVEL: Grade 3-6

STANDARDS: 1A, 1B, 1C, 2A, 3A; 5A

OBJECTIVE: Students will create an Art Portfolio folder, and learn how to scale up/enlarge a photograph using grid lines. Students will learn how to measure and center a perfect square onto a paper. They will know what a right angle is.

INTRODUCTION: Welcome the students, get to know each other, introduce classroom rules, and instructions in creating their art portfolio folder.

PROCEDURE:

1. Each student will fold a white poster in half.
2. Use a piece of colored construction paper, student will measure from edge one, 8 inches, mark a dot with a pencil.
3. Measure the edge two, keeping a right angle of the paper with another 8 inches, mark a dot.
4. Fold the paper at one of the marked dots, using the edge to create a straight

invisible line.

5. Repeat this with the other edge. This will form a perfect square.
6. Cut the square out. This will be your template for drawing your square onto your portfolio folder.
7. On one side of your folded poster, center your square template.
8. Use a pencil, mark a dot on your poster at each of the 4 corners of your template. Be careful to mark your dots as close to the corner edges as possible.
9. Use your ruler, put ruler right under 2 dots and draw a line. Repeat this until your square is complete.
10. Use your ruler, you will mark a dot every two inches on the inside of each line of your square. Demonstrate.
11. Repeat step 9 with the 2 inch dot marks. This will form 2 horizontal lines, and 2 vertical lines. (Forming a grid- Tic Tac Toe pattern). Demonstrate.
12. Use a pencil, draw their first and last name anywhere around the square on their poster. Will color with marker later.
13. Ask students to bring in a picture of their favorite cartoon character, measuring UNDER 4" x 6". This will be used to transfer in a larger scale onto the square on their posters.

Scaling up a picture

1. Use a small picture, draw 2 horizontal lines and 2 vertical lines, equally apart, using a pencil, on top of the picture. This will form a grid as done before on their poster.
2. Draw what you see in each quadrant of your picture onto each quadrant on the

poster. Each quadrant will be identical to the ones on the picture, only larger on the poster.

3. After picture has been transferred to poster, color cartoon character using markers, or color pencils.
4. After picture is colored, using a ruler, outline the square with a black marker.
5. Erase all other pencil marks on poster.
6. Decorate their names with color markers.
7. Tape the two short ends of the poster with packaging tape, to create a pocket folder.

*Show example of a finished portfolio. These will be used throughout the year to keep safe art work and vocabulary word notebook.

MATERIALS: white poster board, ruler, pencil, eraser, colored pencils, colored markers, packaging tape, cartoon character picture measuring under 4" x 6"

MODIFICATIONS: Help students who need assistance writing their name, and or measuring.

VOCABULARY WORDS: right angle, portfolio, template, vertical line, horizontal line, quadrant, scale, grid

CONNECTIONS: Math, Science, reading, writing (Language arts)

<end of lesson plan>

These researchers are scientists, educators, or doctors who have studied the effects of arts integration and the computer enhanced instruction using art. The idea of incorporating the arts into classroom instruction has been gaining popularity nationally and globally for that matter. All researchers in the study agree that arts are seen as having benefits for both cognitive and

effectiveness of instruction in content areas. Many studies conducted have proved this theory.

An ongoing study at the Arts Integration Kennedy Center, who hosted the Arts Integration Conference in 2011, and where educators introduced correlational studies for art integration which was conducted in several schools. At the conference, the educators spoke about a Title I school, with the majority of its members, of minority student based populations. The study is ongoing, and will reveal the test scores of reading and math and of the educational impact of art integration in those minority schools as well as the other public schools in the study in those areas. In my own experiences, anecdotally with other teachers, I find that my art lessons have an impact on students in other classes. For example, in a lesson plan entitled, *One Point Perspective Spheres*, with which students realized a couple of mathematical concepts during the creative process in this lesson, where they incorporated perpendicular lines, and right angles in their designs. The following is this example of the lesson plan:

INSTRUCTOR: Linda Al-Hanna

DATE: September 16- October 11, 2013

TITLE: One Point Perspective Spheres

LEVEL: 4-6

STANDARDS: 1A, 1B, 1C, 2A, 4A, 5A, 5B, 7A

OBJECTIVE: The students will understand the concept of One Point Perspective, and shading technique for sphere shapes. The students will learn how a light source can show multiple shades of a color. The students will understand the mathematical concepts of the right angle and perpendicular line.

INTRODUCTION: Demonstrate use of light source, and choosing one point of

perspective for their drawing. Use online website for digital art to show examples using mathematical concepts integrating art.

PROCEDURE:

1. Have students choose their one point of perspective.
2. From their point of perspective, trace smallest sphere, then medium sphere, and lastly, the large sphere.
3. Begin shading the spheres, keeping the light source in mind, which begins from their point of perspective.
4. From their point of perspective, using a yard stick, draw lines out from the point, avoiding the insides of the spheres. (This will create fan like lines)
5. Draw vertical straight, *Perpendicular* to the lines drawn in step 4, beginning small spacing to large spacing out away from point of perspective.
6. This checkered board design will be colored using markers. Color using two different colors (blue and black for example). Or, they may choose to leave white spaces and color with one marker (red and white for example)

MATERIALS: 12" x 9" drawing paper, yard sticks ruler, colored markers, Jet Blk Smooth Ebony pencils, kneaded eraser and pink eraser, online website (NGA)

MODIFICATIONS: Help students as needed. (IEP)

VOCABULARY WORDS: one point perspective, vertical, three dimensional (3D), kneaded eraser, Ebony pencil, perpendicular line, right angle

CONNECTIONS: math, science, reading, writing, language

After this project was completed, the art students were able to demonstrate to their math teacher the mathematical concepts with a clear understanding.

<end of lesson plan>

There are scientific studies which reveal the importance of why and how art integration through art making is a powerful tool for the learning process of people. According to Dr. James Zull (2005), professor of Biology and Director of the University Center for innovation in Teaching and Education, wrote, *The Art of Changing the Brain: Enriching the Practice of Teaching the Biology of Learning*, states, “one thing we have found is that the brain physically changes when we learn, and that change is most extensive and powerful when emotion is part of the learning” (p. 18). Zull adds, “The chemicals of emotion, such as adrenalin, serotonin, and dopamine act by modification of synapses; and modification of synapses is the very root of learning” (p. 22). As a result, “changing those connections in the brain is learning. In other cases where change does not occur at all, it is due to the fact that the emotion chemicals and structures in the brain were not engaged,” according to Zull (2005, p. 23). Zull argues that art triggers emotion, because artists create things they are then engaging others emotionally, and of course the artist also feels emotion as well (2005). Zull explains, “The reward chemicals such as dopamine have their primary effects on our frontal cortex” (2005, p. 24). “Dopamine is produced in the brainstem, which is the oldest part of the brain evolutionarily speaking, but the dopamine is released in the newest region of cortex, the part that we use to create ideas, make decisions, and plan our actions” reveals Zull (2005, p. 24). The result of this, is we feel rewarded when we are creating something new or doing a new action, which is why neurochemistry of the arts provides the freedom and ownership we experience. Zull (2005) argues, “If we as teachers allow the normal neurochemistry to take over, providing freedom, creativity and mastery, the academics become an ‘art’ and learning becomes enjoyable” (2005, 25). This is the reason many

students remember and love art, because of their ability to have that freedom for creating, experimenting, while learning valuable skills at the same time.

When a kindergarten student draws a circle for the first time using a pencil, it is a circle. But when they shade one half of that circle in a curve, the circle they viewed at the beginning, has changed form. After the shading techniques are applied, they are surprised with delight of their new three dimensional shape—a sphere, which they created as a result of the technique. Their visual perception has been broadened through the drawing process. Likewise, when a kindergarten student sees a sphere on an interactive smart board for the first times, and see the sphere change colors with one click of their little finger, they are also in awe. A student can watch a sphere at an interactive web site, and with a click of the smart pen, sets the sphere into motion by spinning in circles, or be modified to stretch and change form in a second. Therefore the smart board is another tool where students can create digital art using another method and experience a new way to create art.

REFLECTION

The implementation in digital art is on the rise, as educators realize the potential for advancement in aesthetics, creativity, and imagination of their students. A curriculum should include major units of study which students are engaged in the creative process using various electronic devices. This includes printing techniques and saving an electronic image. Workshops and computer training for art teachers in digital technology are essential. Today the curriculum is using multi-media formats in many subject areas. For the art classroom, teachers need to prepare students in all applications of the computer. The visual art teachers can also bring the museum virtually to the classroom through the use of the computer for interactive or remarkable visual experiences in art. Visual disk libraries of images are being developed by most museums, according to Stanley Madeja (1993), who is Dean, at the Visual and Performing Arts, in Northern Illinois University.

For example, the National Gallery of Art has developed video disks of their art collections, which provide the online viewer instant access to art imagery. Other data banks are available to the online viewer, such as National Geographic Magazine, and Time Life. Another is the National Archive and the Library of Congress which have visual data banks that provide historical images and resources for a variety of educational applications in the visual arts (Madeja, 1993). My art class recently visited the National Gallery of Art online, while I introduced one of the basic elements of art, *shape* by analyzing the types of shapes used in various works of art to differentiate between geometric and natural shapes for the lesson. We discussed the fact that many artists use different shapes in their artwork and then we had a discussion about the differences between the terms bio-morphic¹⁷ and geometric¹⁸ shapes. At this

¹⁷ biomorphic means: life-form (bio=life and morph= form). Biomorphic shapes are often rounded and irregular, unlike most geometric shapes.

web site, they were able to view images of Piet Mondrian's *Tableau No. IV*, Edward Steichen's *Le Tournesol (The Sunflower)*, Vincent van Gogh's *Roses*, and Henri Matisse's *Woman Seated in an Armchair*, and were able to choose which artist used geometric shapes and which used biomorphic shapes in their art pieces. By analyzing the types of shapes used in various works of art to differentiate between geometric and natural shapes, they were able to understand the differences and create their own cut paper collage based on a theme, geometric or biomorphic shapes, they selected.

Technology has come a long way, from slides, filmstrips, and over-head projectors to the digital camera, DVD and Smart Board (interactive white board), to name a few. People today no longer need a TV screen or VCR to show a video. Also, there is no longer the need to hand write a letter to be delivered through the post office. Schools need to provide today's modern resources and must be available for our students' use. Art educators must keep up with what technology has to offer and stay current with the ever changing classroom equipment that students utilize in their learning.

¹⁸ Geometric shapes are precise and regular, like squares, rectangles, and triangles

CONCLUSION

Many researchers and educators such as Joanna Black and Kathy Browning agree, that working with new media and technology, positively develops student's problem solving skills, visual reasoning skills, creative thought, exploration and expression. Traditional visual arts provide the foundation for digital arts. These hands on activities lead to interpretations that can be applied to digital painting and drawing. Allowing students to explore and become self-motivated in the creation process, is crucial for the constructivist¹⁹ classroom. Digital technology is an important tool teachers can utilize in the art classroom for the purposes of instruction, lesson planning and student interaction. Research involving educational and scientific studies has proven that implementing art combined with computers and technology in the classroom, positively benefit student learning. Digital art applications are playing an important role in every aspect of our daily lives. They are advertising, marketing, science exploration, mathematical venues and engineering solutions, to name a few. The future of our student's careers will be involved in some aspects of computer designed images or software programs, for example. Today the art teacher has the opportunity to exceed the traditional art practices and introduce digital art to our students, so they will gain today's modern skill for enhancing imagination and creation while fostering the skills needed for students' future. Traditional art practices must still be in place but there must also be other avenues in which the student may explore in learning and creating. The art curriculum must be a balanced pedagogy for the many different learning styles of students. Digital art technology is an exciting medium which should be a part of the creative and design processes for the student, to express themselves using a variety of art forms and techniques.

¹⁹ Constructivist teaching fosters critical thinking, and creates motivated and independent learners.

RECOMMENDATION

Art spaces need to be compatible to the art program of the future. The art classroom needs an area for computers, a printing station, a library of software for digital art, an interactive smart board, document camera, and of course, plenty of work space for the hands on work projects and for traditional supplies and materials.

Administrators and policy makers need to support art education strategies by providing teacher training in technology, and supplying the necessary resources to purchase software, hardware, and computers for the art class. They need to accommodate the required and appropriate time length for an art class period that can include traditional and digital visual learning.

More studies can play a big part in the implementation of art and digital technology in the school system, because the members of the board of education and entities responsible for our student programs will have the research to back their support. Schools need to be more willing to involve their students in these studies. Legislatures need to be the voice of our educators and legislate for the necessary funding of our student's learning materials and training for the teachers who will teach our future leaders of the world.

Art teachers must learn and assist in the development of an art curriculum which implements digital art in the classroom environment. They need to be advocates for their rights of their art students, for the proper allotments of time, space, equipment and materials needed for the production and learning of modern art.

At the college level, technology courses for the instructional practices for art education majors must to be available for our future art teachers. Technology must be a part of the student's internship learning experience to prepare art teachers to teach students digital art and

the technology involved. Providing teacher training in professional art practices is essential to making a successful art teacher. But most of all, understanding that students learn in different ways is essential. As an art instructor, my teaching philosophy is directed toward Howard Gardner's theory of Multiple Intelligences and the advice he conveys.

Howard Gardner validates: "we are all able to know the world through language, logical-mathematical analysis, spatial representation, musical thinking, and the use of the body to solve problems or to make things, an understanding of other individuals, and an understanding of ourselves. Where individuals differ is in the strength of these intelligences - the so-called profile of intelligences -and in the ways in which such intelligences are invoked and combined to carry out different tasks, solve diverse problems, and progress in various domains" (Gardner, "Multiple Intelligences," 1991). Digital technology is an important option the art student has to create, explore and experience as another medium for creating art.

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SUMMARY OF KEY IDEAS FOR DIGITAL ART INTEGRATION IN THE CLASSROOM

When combined with traditional instruction, the use of computers can increase student learning in the modern art curriculum and basic skills areas.

- Integration of computers with traditional instruction produces higher academic achievement in a variety of subject areas such as art vs. the traditional instruction alone.
- Students learn more quickly and with greater retention when learning with the aid of computers.
- Students like learning with computers and their attitudes toward learning and school are positively affected by computer use.
- Use of computers appears most promising for low achieving and at-risk students.
- Effective and adequate teacher training is an integral element of successful learning programs based on or assisted by technology.

Technology is best used as one component in the art classroom in a comprehensive improvement effort.

- Art teachers must be adequately trained to use technology.
- Technological resources must be sufficient and accessible.
- Effective technology use requires long-term planning and support.
- Technology should be integrated as one component into the curricular and instructional framework.

VITA

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