Digital Arts for Computing Outreach

Karen C. Davis
University of Cincinnati, karen.davis@uc.edu
Laura Greene-White, Ted Ferdinand, Mark Santangelo
Cincinnati Arts and Technology Center

Abstract – In this paper, we describe a partnership between University of Cincinnati (UC) and the Cincinnati Arts and Technology Center (CATC) faculty with the goal of introducing high school students to computing in a fun but challenging way. We developed and delivered a summer workshop that leverages the successful experiences at CATC in promoting student engagement and accomplishment with a college experience using computers to create an original, digital artwork based on the Harlem Renaissance movement. In the workshop, the students viewed the work of artists in a computer lab and discussed artistic themes and techniques. The students toured the UC campus and used disposable cameras to collect their own photo images of people and architecture. In the digital media studio at CATC, students used their images (developed digitally) to construct photo collages using sophisticated filtering and other artistic techniques in Adobe Photoshop. A gallery exhibit of student work was held in the student center at UC at the culmination of the workshop. Nineteen students participated: 10 females and 9 males; 10 were African-American, 2 Hispanic, 6 white, and 1 other. The workshop was assessed with pre- and post-surveys that investigated computer usage and confidence using computers.

Index Terms – K-12 outreach, digital arts, Harlem Renaissance, photo editing.

INTRODUCTION

Decreasing enrollment in computing disciplines in post-secondary programs is attributed in part to lack of exposure to the field in an engaging manner. In a survey of over 4,000 Cincinnati area high school and middle school students, students answered questions about their perceptions of and interest in studying engineering disciplines (including computing science) [1, 2]. For the students who would not consider engineering as a profession, the overwhelming reason at all grade levels and broken out by gender and ethnicity ranged from 84-90% in the following category: “Lack of knowledge, negative impressions of self capabilities, no desire to pursue prerequisite coursework, and dislike for the engineering profession.”

Other findings of the study were widespread misconceptions about what engineering skills are used in the workplace. Student responses mixed engineers with technicians (e.g., “they drive trains” and “repair broken stuff”) and generally did not find the profession appealing (e.g., “do not have opportunities to enjoy life.”) The study did not focus on computer science specifically, but it may indicate that students are generally unaware of what persons working in technical professions do, and therefore they are not motivated to study the foundation subjects to enable them to continue their studies as they advance through high school. They are not prepared to study science and engineering in college without these foundations, and thus doors are closed to them because they lacked early enough positive exposure to encourage them in obtaining science, technology, engineering and mathematics (STEM) knowledge and skills.

The National Science Foundation’s program for Broadening Participation in Computing (BPC) supports creative and innovative ways to engage and retain underrepresented groups in studying computing at the post-secondary level. As part of an NSF BPC program, “Mentoring for Connections to Computing (MC2),“ we developed and conducted an outreach activity for rising 11th and 12th grade urban students. The activity was a workshop in digital arts that included working in a computer lab and touring the University of Cincinnati campus (with cameras), as well as learning to use sophisticated image filtering and manipulation techniques in a digital arts studio. The workshop goal of developing fun and challenging computing-related activities aligns with the grant’s goal of engaging underrepresented groups but does not directly address recruiting and retention; these goals are addressed in other aspects of the grant [3].

The digital arts studio is located at the Cincinnati Arts and Technology Center (CATC) and the workshop content was developed and delivered by CATC faculty. CATC is a non-profit organization that enables 11th and 12th grade CPS students who are at risk of not graduating from high school to earn fine arts or elective credit in an after school program. They typically have around 400 students enrolled per year; 93% (2007) and 96% (2008) of the students who participate in the CATC program go on to graduate from high school. The students participate in a standards-based curriculum where they learn about the historical and social context of artistic movements and participate in creating their own original work in a traditional studio (sculpture or painting, for example) and also in a non-traditional studio using digital media and computer technology. The environment at CATC is welcoming and non-threatening; the digital arts...
technology lab serves as a first exposure to computing for many of these students.

By dovetailing the need for computing outreach with the CATC mission, we created the first annual Digital Arts Workshop and conducted it in June 2007.

WORKSHOP ACTIVITIES
The activities of the three days of the workshop are described below.

I. Day 1: Harlem Renaissance and Image Collection
At UC in a computer lab, the students view a movie created by CATC about the Harlem Renaissance movement. The movement refers to a period of rich cultural expression based in the African-American community of Harlem in New York City; the period began around 1920 and extended to 1940. Visual arts, poetry, and music thrived and created a lasting legacy that influenced mainstream culture and ultimately promoted civil rights. The movie gives a brief overview of the lives and works of African-American painters and sculptors. For the workshop, pieces by collage artist Romare Bearden will provide the focus. Bearden produced both portraits and cityscapes using photomontage and painting techniques. His themes include everyday life both in the rural south and in northern cities.

Students investigate artistic concepts and themes that inspire them and begin to plan their own original work under the supervision of CATC director Laura Greene-White and instructors Mark Santangelo and Ted Ferdinand. The students are engaged in discussion and interaction by answering questions posed to the group such as “What do you want (hope) to do?” The questions and some representative student answers are illustrated in Table 1.

After the initial questions are discussed, the instructor outlines what the goals of the workshop are using the prompt “What do we want you to know and be able to do?”

1. summarize the Harlem Renaissance (who, what, where, when),
2. analyze the art of the Harlem Renaissance for common themes and subjects (e.g., history/identity, people/music, culture of every day experiences, expression/repression),
3. analyze a favorite artwork of one artist for the use of elements of art (e.g., line, shape, color), principles of design (e.g., contrast, balance, pattern), and style,
4. synthesize what you conclude into a plan,
5. produce using technology, and
6. imagine.

When the plans for their artwork are completed, the high school students are escorted on a walking tour by UC computing undergraduates and CATC faculty to photograph architecture and people using disposable cameras. The film is then developed on CDs, which are loaded onto the server at CATC.

II. Day 2: Original Artwork Creation
The next session is at CATC. The digital photo galleries for each student are posted on a server, and they can all view and use each other’s images, the instructors’ photos, and images collected via the internet. The students learn to use photo-editing software to construct their own piece of art based on the concepts and themes identified in the previous session. The students display their work to each other, and they cooperate to select some images to be printed larger for display in larger matted frames. Everyone’s art is matted and framed for a gallery exhibition at UC on the final day of the workshop.

<table>
<thead>
<tr>
<th>INQUIRY AND STUDENT RESPONSES</th>
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<tbody>
<tr>
<td><strong>What do you want (hope) to do?</strong></td>
</tr>
<tr>
<td>new experiences</td>
</tr>
<tr>
<td>learn how to work with pictures on a computer</td>
</tr>
<tr>
<td>get some gnarly pictures</td>
</tr>
<tr>
<td><strong>What do you hope to learn?</strong></td>
</tr>
<tr>
<td>what the movement means to us</td>
</tr>
<tr>
<td>skills/techniques used</td>
</tr>
<tr>
<td>how did it start?</td>
</tr>
<tr>
<td><strong>What do you need (want) to know?</strong></td>
</tr>
<tr>
<td>how did it affect/change people? society?</td>
</tr>
<tr>
<td>does it play out today?</td>
</tr>
<tr>
<td>why did it happen?</td>
</tr>
<tr>
<td>was it accepted?</td>
</tr>
<tr>
<td>help progress civil rights movement?</td>
</tr>
<tr>
<td><strong>What do you know?</strong></td>
</tr>
<tr>
<td>jazz and American culture</td>
</tr>
<tr>
<td>African-American talent was realized</td>
</tr>
<tr>
<td>new art styles</td>
</tr>
<tr>
<td>changed lives of African-Americans and all</td>
</tr>
<tr>
<td><strong>How does it change what we can do today?</strong></td>
</tr>
<tr>
<td>freedom of expression</td>
</tr>
<tr>
<td>styles inspire us</td>
</tr>
</tbody>
</table>

Example Student Photos
Examples of some of the raw images photographed by students are shown in Figure 1. The next section describes how these images are translated into original artworks, and Figure 7 illustrates completed student work.

Using Photoshop
Instruction in Adobe Photoshop consists of two 2-hour sessions designed to give students a hands-on, working knowledge of the basic functions of the program. Included in these sessions is an overview of digital imaging, which allows learners to better understand the functioning of the tools and how they apply to the manipulation of digital images within the program. Image formats and their respective compression algorithms, pixel resolution, color theory/mode and image capture (basic photographic
techniques, web resource and scanning) are some of the core areas addressed in this overview.

Working with acquired images, the three basic areas of the Photoshop GUI (graphical user interface) are presented and explained to students on a digital whiteboard (Figure 2). Students follow along on laptop computers, allowing them to immediately utilize the functions of Photoshop. This includes the Photoshop toolbar, tool option bar, menu bar, and palettes. Each area is addressed by demonstration of its function on selected images. This includes selection, transformation, and modification of images using the tools and various menu options.

Artistic creation within the program is also demonstrated through the use of brushes, gradients, pen/pencil, shapes, and text operations, allowing students to create original artistic backgrounds (Figure 3), fills and brushstrokes (Figure 4). These facets of the program are also applicable to the modification of existing images. The course culminates with image compositing using layers, masks, blending options, and layer style, and the application of Photoshop filters to achieve dramatic artistic effects (Figure 5). Each student is then provided the opportunity to complete an individual work, based on their own captured/acquired images. CATC instructors provide each student with a Photoshop quick reference guide that outlines the basic use of the tools and various other areas of the program to further reinforce material covered in the overview. Instructors are on hand to answer questions that arise during the individual creation process and to assist students.

Art Exhibition

The final day of the workshop consists of an exhibition of student work in the UC student center. The exhibition is open to the public and students are encouraged to invite their families and friends. Each student selects one of their artworks to frame and matte, and the works are displayed using tabletop easels. A photograph of some students and their works appears in Figure 6a, and the instructors are shown with student work in Figure 6b.

STUDENT ART WORK

Figure 7 contains examples of original digital artworks created by high school students on the second day of the workshop. The pieces include photographs taken by the students during a walking tour of the UC campus as well as some images found on the internet using Google’s image search engine. The upper middle image in Figure 7 won top honors at the Ohio Association for Gifted Children Art Exhibition in Summer 2007.

ACADEMIC STANDARDS

The workshop activities are aligned with both Fine Arts and Technology Academic Content Standards established by the Ohio Department of Education [4]. The relevant Fine Arts: Visual Art standards for grade 12 and corresponding workshop activities are discussed below.

Historical, Cultural and Social Contexts
- Understand and apply knowledge of art history: students complete a worksheet about the Harlem Renaissance movie’s description of the movement.
- Identify/compare relationships between artworks: students identify/compare relationships between masters’ art works.
- Incorporate knowledge from art history: students use collage and other artistic techniques observed in masters’ works.

Creative Expression and Communication
- Integrate elements of art and principles of design: students analyze masters’ works based on the following elements: space, balance, color, pattern, and contrast.
- Solve visual art problems demonstrating skill: students use these same elements in constructing their own design.

Connections, Relationships and Applications
- Analyze cultural influences on art in America: students discuss the impact of the Harlem Renaissance during the inquiry and discussion activities (Table 1.)

ODE Academic Content Standards for Technology (K-12) are aligned with national standards, including the standards of the International Society for Technology in Education (ISTE) and the International Technology Education Association (ITEA). The applicable ODE technology standards for grades 9-12 [5] are:

Standard 1. Nature of Technology:
B. Apply technological knowledge in decision-making: students decide which images to use by navigating directories and using Google’s image search engine; students decide which filters and artistic techniques to apply in the construction of their artwork.

Standard 3. Technology for Productivity Applications:
B. Identify, select, and apply appropriate technology tools and resources to produce creative works and to construct technology-enhanced models: students enhance and manipulate digital images with software to create an original work.

Standard 5. Technology and Information Literacy:
D. Evaluate choices of electronic resources and determine their strengths and limitations: students use Google’s image search engine and Adobe Photoshop to make decisions about content and appearance of images in their work.

Standard 6. Design:
C. Understand and apply research, development, and experimentation to problem-solving: students experiment with the visual effects of filters to achieve desired results.
FIGURE 1.
EXAMPLES OF STUDENTS’ PHOTOGRAPHS TAKEN AT UC

FIGURE 2.
SCREEN-SHOT OF THE PHOTOSHOP GUI SHOWING TOOLBAR, OPTIONS BAR AND PALETTES

FIGURE 3.
BACKGROUND CREATION USING THE GRADIENT TOOL

FIGURE 4.
ADDITION OF BRUSHSTROKES USING DROP SHADOW AND STROKE

FIGURE 5.
ADDITION OF PHOTOGRAPHIC CONTENT AND DEMONSTRATION OF LAYER BLENDING
ASSSESSMENT

In compliance with the UC Institutional Review Board regulations, each student under the age of 18 had to sign an assent form and their parents had to sign a consent form in order for their data to be used for publication. Students 18 and older were able to sign a consent form without parental consent being required. All of the participating students provided the necessary signatures. A pre- and post-survey was administered to the students that requested some demographic data as well as perceptions about using computers, actual computer experience, and experiences with computers and mentors during the workshop.

The demographics of the 19 students who participated were:

- 10 females and 9 males
- 10 were African-American, 2 Hispanic, 6 white, and 1 other
- 15 had made previous visits to colleges and all were planning to attend college

Questions on the initial survey include: how often students use computers at home and at school, attitude and confidence about using computers, and why they chose to participate in the workshop. Questions on the exit survey include: how many hours of computer time did they experience during the workshop, number of times they sought help from a mentor, confidence about using computers after the workshop activities, and degree of satisfaction from creating their own art work.
The students reported that they frequently used computers in the home and slightly less frequently at school. Given the low socio-economic status of most families in the Cincinnati Public School district, this was an unanticipated result. This may be due to the fact that students self-select for attendance at the workshop; students who are not as comfortable using computers may not choose to attend.

Students reported spending 3-4 hours working on their artwork on a computer, and most sought help from mentors 6-10 times while completing their work. Interestingly, the student average for confidence about using computers dropped slightly after the workshop compared to before the workshop; the difference is not statistically significant, but it might indicate that exposure to a complex software tool such as Photoshop expands their understanding of what computers can do. Future workshops in the second and third year of the grant can explore this in more detail.

Students reported what they liked the most about the workshop:
- “I liked the hands-on atmosphere.”
- “The way you can blend different people in pictures together.”
- “Just being able to use the computers. Being influenced to do the artwork.”
- “I got to work on my very own piece for a very long time and had great help when needed.”
- “I liked using the pictures I took to create an image about my feelings.”
- “Working with computers to create images.”

Student engagement, enthusiasm, and personal success experienced were evident in the workshop activities and feedback. Students also reported what they liked the least:
- “Not having more time to work.”
- “Extend the length to do more work with it.”
- “At first you can get confused very easily.”
- “Digital cameras with screens would be fantastic.”
- “Have an advanced workshop.”

We can try to address the request for more time and more clarification in the session, but funds are not available for digital cameras or another more advanced workshop.

In addition to the 19 attendees, 21 additional students who signed up for the workshop did not attend. The students received a packet in the mail containing a schedule of the activities, directions, UC IRB forms (student assent and parental consent), and the NSF image permission form. The PI and the CATC faculty called each student the week before and the night before to remind them. Most confirmed their intention to attend; but transportation appears to be a huge issue for inner city children because they did not show up. We provided free transportation from CATC to UC and from UC to CATC or the central city bus depot, along with tokens to get home, but we still feel that other steps should be taken in the future. In order to improve attendance at future workshops, we plan to call the students in advance of the workshop and send transportation instructions to their homes.

Additional evaluation of the data is currently underway by UC’s Evaluation Services Center personnel.

**Conclusions**

The following goals for our high school student participants were achieved; they were able to
- learn about an artistic style in an historic and social context,
- use a college computer lab,
- tour campus and meet current computing students,
- collect photos to form an original image gallery,
- use a computer to create an original art work, and
- share the work in a public display.

The following goals for the UC students were achieved; they were able to
- engage in mentoring youth while supervised by high school teachers, and
- share highlights about college education and show the campus.

The following goals for the UC faculty member were achieved;
- learn how to conduct a multi-day workshop,
- evaluate the effectiveness of digital arts as an outreach activity,
- learn to use digital arts software,
- engage in mentoring youth while supervised by high school teachers, and
- promote the activities of the workshop to the community.

Our experiences indicate that a digital arts workshop can be an effective way to engage students with computing. We believe that experimentation and goal-directed activities with computers and art can increase a student’s confidence about further computing studies.

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**References**


