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Enhancing Education through Digitization

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I am a senior at the University of Kentucky, studying elementary education and graduating in May, 2004. During my career at the University, I have been on the Dean's List six semesters and will be graduating Magna Cum Laude. I have completed my practicum and student teaching experiences at the professional development school, Squires Elementary. I have gained extensive technological experience working at the Digital Media Networking lab at the University of Kentucky for the last two years. In May of 2004, I will be conducting research with Dr. Brent Seales and his staff in Puerto Rico. Following graduation, I plan on teaching in Lexington. Shortly thereafter, I plan to return to the University to pursue a master's degree in administration or instructional systems design.

Jessica Muetterties has worked in my laboratory for almost two years and has been a valuable contributor to my research efforts. Her willingness to take a risk by working outside her immediate area (Education) has been a very positive experience for my research group. Her submission to *Kaleidoscope* represents an honest appraisal of her experience in contributing to a research project as an undergraduate, and I think it gives a valuable picture of what that can be like — her story should appeal to others on campus who may also have research opportunities.



Mentor:
Dr. W. Brent Seales,
Professor, Department of Computer Science

Enhancing Education through Digitization

Abstract

As technology becomes more a part of everyday life, it is increasingly important that future and current educators learn how to integrate the use of technology into day-to-day classroom activities. Teachers must learn to embrace the fact that computers and other aspects of technology are used by children everyday; the classroom needs to incorporate new and emerging technology. In this essay, I describe my experiences as an education major working in a research laboratory in Computer Science at the University of Kentucky. My work in the lab taught me how to digitize, process, and prepare on-line presentations of a variety of artwork. This experience has given me a first-hand glimpse of what it will take to incorporate technology into my classroom in the future. The possibilities and learning opportunities that exist for teachers who are adept at using and integrating technologies are exciting.

Introduction

As an elementary education major, looking for a part-time job, I found little from which to choose. Typical education-related jobs available to undergraduates include working at a daycare center, after school programs, or in-house babysitting, yet few offered a career-enhancing opportunity that aligned well with my professional development. While it was tempting just to continue babysitting, I knew from my training that education has many more facets and requires skills beyond childcare.

At the start of Fall, 2002, I interviewed with Professor Brent Seales in the department of Computer Science. At that point, my computer knowledge consisted of using the Internet, *Microsoft Word*, *Excel*, and *PowerPoint* — which at the time I felt was all there was to know. We discussed different project opportunities. I realized then that the work would be challenging but educational. I was hired several days later and began working at the Digital Media Networking (DMN) lab.

There were some surprises when I first started working in the lab. As an education major at UK, I was always surrounded by like-minded friends. In Computer Science I felt like a minority. The gap between my experience with computers and the expertise of the others in the lab was noticeable,

and the gender gap (there are far fewer women in Computer Science than in Education it seems) was also surprising. I realized instantly that this experience was going to be a unique opportunity with potential impact for my future career in education. Although initially intimidated by my lack of computer skills, I began exploring different programs and taking advantage of the knowledgeable people who worked around me. Early on in my exploration, I realized the incredible impacts that my work with technology had on my career in education. Every project I worked on was intertwined with an educational component. I have had the opportunity to work at the lowest level of gathering data, the final level of actually displaying data so that a user can have access to it, and various levels in between. My goal as an educator is to make resources available from which students can learn. My experiences in the DMN lab have provided the groundwork for me to do so.

Digitization Experiences

My current and, perhaps, most intriguing educational project while working at the DMN lab has been a collaboration with other computer science students to digitize, process, and present artwork from Puerto Rico. The goal of this project was to create a way for the average person to have access to art collections that would normally be inaccessible. My personal goal was to be able to create something simple enough so that a young student could easily have access to it and yet make it interesting and aesthetically pleasing enough that an adult viewer would also learn from the display. As an educator, the main goal when teaching or presenting anything to students is to ensure that they will gain knowledge on the presented topic. Through the steps of acquiring data, digitizing raw data, processing data, and in the end creating an accessible display, our team was able to accomplish this goal.

Professor Seales and two of his Ph.D. students from the DMN lab traveled to Puerto Rico during the summer of 2003. In Puerto Rico, they filmed many historic paintings and sculptures that had been kept in storage at the *Instituto de Cultura Puertorriqueño*. According to the Institute's activity coordinator, Carmen dorres Rodríguez, over one hundred sculptures and eight hundred paintings are kept in storage. Many of these sculptures and paintings have been damaged due to the natural aging process. In order to begin digitizing the paintings or sculptures, it was necessary to film them from a variety of positions and angles. To do so, the sculptures were placed on a turn table that was rotated 360 degrees. Both the paintings and sculptures were filmed by two

different video cameras, and digital still pictures were taken as well.

My co-workers returned home with hours of interviews, paintings, and sculptures from the *Instituto de Cultura Puertorriqueño*.

There are several processes that must occur before any of the art is suitable for viewing. The first step is to import the video footage into the computer system. To do this, I imported all of the raw videotape footage of the sculptures into the computer using non-linear video editing hardware and software. I then began to view the videos and make the necessary cuts between each sculpture's rotations. It was also necessary to make sure that all views were kept synchronized and cut in the same places. Once all of the video, from both cameras, was synchronized, directories were made for each sculpture, twelve in total. Using the two synchronized video clips, I then created 360 still frames of each sculpture from each viewpoint. This was done by importing the raw video clips into *Adobe Premiere 6.5*. (Figure 1.) (Color figures are on p. 47) Using chromakey, I removed as much of the original blue screen background as possible. (Figure 2.) Once a chromakey was in place, I exported the video footage into 360 still frames — a full rotation of each sculpture.

After 360 images of each sculpture were created, the rest of the background needed to be removed from each individual frame, so that the sculpture is the main focus and there is no unnecessary background "noise." Using *Adobe Photoshop 7.0*, I carefully removed the background of each object by hand. This was a difficult task because the work had to be absolutely precise in order to keep the sculpture in its true form. Each frame was magnified about 500 percent and I erased all background and the turn table from the frame. This task took approximately three to five minutes per frame.

While removing the background, I also fixed specific parts of sculptures that had been broken in the past. For example, in the piece *Mascara de Vejigante*, one of the horns was destroyed due to the natural aging process. (Figure 3.) I copied a horn from another part of the frame and added it onto the sculpture. I then used *Photoshop* features to blend the original frame with its repair. This repair is not obvious to the observer and can be done easily to enhance the appearance of an animation. (Figure 4.)

Digitally repairing a damaged piece of sculpture can enhance the aesthetic and educational value of a piece, but negative implications of "correcting" a sculpture exist as well. Aging and other damage can cause a sculpture to change in appearance and lose the form that the artist originally planned for. In cases such as

these, repairing the sculpture as best we can to its original form can be a great justice to the artist's creation. However, in order to repair a sculpture, assumptions have to be made. Copying from another part of the sculpture could be close to the artist's original creation but there is no way to be sure that my interpretation is completely accurate to the artist's vision. Furthermore, if the damage occurred a long time ago, the piece may have come to be known and appreciated only in its damaged state, not its original form, as with, for example, the *Venus de Milo*.

When the background and missing parts are added back onto the sculptures, there exist 360 frames of art against a blue background. The still frames are then imported into *Adobe ImageReady 7.0* and an animation is created. This allows us to show a full rotation of just the sculpture. The speed of the animation can also be controlled. This process was done for each sculpture and from each viewpoint. In the end, there were 24 different animations.

Display

The next step in the project was to determine a way to present the sculptures that had been digitized and processed. To be consistent with the goal of the project,

we chose to display the data in an easily accessed resource. We created a website (<http://dmn.netlab.uky.edu/~jess/museum/>) for an audience to view the different sculptures, as well as to read related biographical information. (Figure 5.) The user is able to choose a sculpture and see it rotate 360 degrees from two different viewpoints. The website also allows the user to view various paintings that were filmed and photographed.

Through the use of multiple projectors it is possible to create a gallery that can immerse the user in the museum environment. (Figure 6.)

Sculpture images and rotations, as well as paintings, can be displayed such that the user can actually walk around and view the art. Several times a year, *Instituto de Cultura Puertorriqueño* loans out different pieces to other institutions in the United States. In order to do so, they have to specially wrap and ship the items. This can result in a very costly loan. However, creating a digital museum eliminates the deterioration and cost worries that can result when another museum borrows a piece. (Figure 7.)

A virtual museum was also created to display the sculptures and paintings. An environment is created in which the art pieces can be reproduced. Users can then "walk" through a museum either on their computer screen or physically through the use of multiple projectors. (Figure 8.)

I was fortunate enough to work on an entire display project from the lowest levels of gathering data to the highest levels of display. I not only have an understanding of the necessity of technology, but I have had the opportunity learn from the inside out the steps involved in creating displays.

Why is this important?

This project allows us to display, in an easy-to-access format, information that normally is unavailable to the public. The *Instituto de Cultura Puertorriqueño* does not have sufficient space to display all of the artwork they have in their possession — therefore, the pieces have been lost to the public. By digitizing and processing the art, we were able to create an entire museum of priceless art works that would otherwise be inaccessible. This could have a significant cultural impact on our generation. Before these types of technology capabilities, people were limited to experiencing culture through their local museums, books, or television. A Kentucky student would never have the opportunity to experience artworks from the small island of Puerto Rico. Creating digital and virtual museums as well as a web page, allows people to truly experience what they were unable to experience before. Actually watching a sculpture from all angles or zooming in on a detailed painting is much more interesting and beneficial than reading about it or seeing a flat art image in a book. Allowing widespread access to different cultures through something as readily available as the Internet can educate people in a whole new dimension.

Digitizing paintings and sculptures is also a way to preserve and "repair" the artworks. Damage done by the natural elements or storage can often ruin a piece forever. However, if an image is displayed in a virtual museum, there is no damage done to the piece. As shown above, it is relatively easy to "replace" a

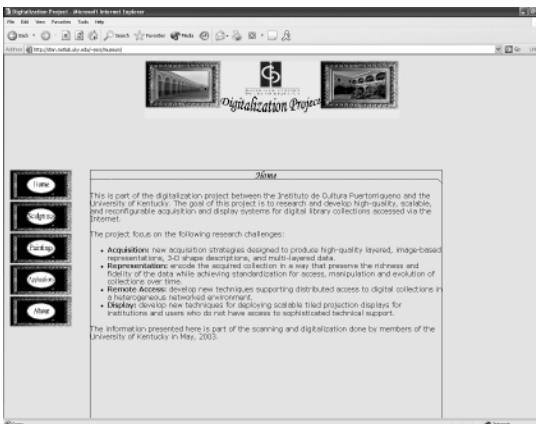


Figure 5. dmn.netlab.uky.edu/~jess/museum/



Figure 6. Projected gallery

piece of a sculpture that has been broken off in the past. "Repairing" sculptures through technology allows the work to be viewed in a whole new way, yet does not cause any change to the actual object; viewing value is added but no value is lost from the actual physical sculpture. We also have the capabilities to enhance artworks. Not only can a missing part be added, but colors can be enhanced or specific detail can be focused upon. The possibilities are endless. Digitizing museum pieces can improve the appearance and educational value of artwork and dramatically change how we view and experience art.

Implications for an elementary teacher

As a future elementary school teacher, I was required to take a one credit technology class. In the class, we were taught the basic functions of the *Microsoft* programs. Although it is necessary to teach basic software applications, the class only scratched the surface of ways to incorporate technology into the classroom. There were no in-depth talks about why or how one can realistically use technology in a real school setting. Future and current teachers alike need to learn how to use technology to enhance education. Anyone who is taking the responsibility of educating the youth of America into his or her hands needs to be prepared to incorporate technology.

It is no surprise that many teachers feel that they do not have the time or ability to use technology in the classroom. It can be intimidating to use a machine that one day simply appears in the classroom. Many teachers have the belief that they need to be "experts" on technology applications and be proficient in trouble shooting (Burns, 2002, p. 298). This misconception can be a great barrier for teachers and their desire to incorporate technology into the classroom in a variety of ways. In a recent on-line survey conducted by the Fayette County Public schools (2003, p.10) only 42 percent of teachers responded that they use a variety of teaching strategies that incorporate technology each week, and only 22 percent reported incorporating it daily. Yet in the same survey, 91 percent of the teachers responded that they felt that technology increases student motivation. These percentages are telling. If teachers are aware that students are motivated by technology, why are fewer than half of them choosing activities that incorporate the use of technology?

I feel that we are doing our students a significant disservice if technology is not incorporated into the day-to-day classroom activities. At home, many children have computers, the Internet, DVD players, digital cameras, and video game systems. It is limiting and naïve for teachers to act as if technology is not

already a major part of children's lives. Teachers need to embrace a child's technology experiences and build upon them. "Digital technologies can enable students to become more active and independent learners. The Internet will allow new 'knowledge-building communities' in which children and adults from around the globe can collaborate and learn from each other. Computers will allow students to take charge of their own learning through direct exploration, expression, and experience. This shifts the student's role from 'being taught' to 'learning' and the teacher's role from 'expert' to 'collaborator' or 'guide'" (Muir-Herzig, 2004, p. 114). Future teachers need to be prepared to teach with technology, not just incorporate a word processing task to check technology off the list.

I know that teachers of all grades can realistically incorporate technology into the classroom. However, school systems do not typically have the software that I used with my Puerto Rico project, but the Microsoft programs are usually available. Many schools also have video and digital cameras. Students need to be taught at the beginning of the school year and have concepts reinforced throughout the year via the use of specific applications; teachers need to be creative in the ways that they incorporate the technology into the state curriculum. For example, if a student has to prepare a presentation of moon phases, which is consistent with the Kentucky curriculum, he or she could do this presentation using information found in the student textbook, displayed on a paper poster board, or the student could create a digital presentation. The student can use actual pictures he or she took of different moon phases and use research gained through the Internet and science textbook. Immediately, the student's peers are interested by the technology and the real photographs, and the student who created the project learned more by actually documenting in a professional way his or her research.

Creating and using web pages is also a great tool in the classroom. Many teachers have a web page on which students can check homework assignments and view other's work. Students themselves should also be included in the creation of web pages. Students can display their personal work and keep it current with projects they are working on. The student who created a moon phase *PowerPoint* presentation could display his or her moon phase photographs and give ideas for others to view and benefit from.

Teachers also need to be aware of all the resources that are available on-line. There are many wonderful databases that are kid-friendly and safe. There are also sites similar to the one I created on which students can take virtual tours of places they normally would not see. I used a virtual firehouse tour with

kindergarteners. These students had all seen a fire truck before, but through the website tour they were able to “walk” through a fire house and explore a fire truck. This exploration gave students choices. They chose where they wanted to “walk” and explore next. This made a much larger impression on the students than just a class discussion or picture book.

The possibilities are endless, but teachers need to take the initiative. Every teacher should be capable of incorporating technology into the classroom for authentic activities. Educators need to be on the same track as society and take the risks and explore the opportunities that technology can provide.

Teachers are not the only people who need to be held accountable. School districts also need to provide support in order for teachers to be successful. Once teachers have the desire to incorporate technology, they often become discouraged due to the lack of current resources and enough resources for each child. It is difficult to use a computer that is out-dated and extremely slow. It is also challenging to use technology if there are not enough resources available in the schools. One computer lab is not sufficient in meeting a school’s needs, if all teachers begin to integrate technology into their curriculums. I know that it is not realistic to ask the school districts to put twenty new computers with current software and access to the Internet into every classroom across the state of Kentucky, but I do feel that many improvements can be made. Parents, teachers, professionals, administrators, and other members of the communities need to unite and begin providing support to the school systems. One cannot lay all of the responsibility for what occurs in the schools on the teachers and administrators — it is the responsibility of society as a whole.

What will I do now?

As I leave the University, I am faced with the question “what *will* I do now?” Many recent graduates are intimidated about the possibilities that lie ahead, but I cannot wait to jump right into the work force. My possibilities as a new graduate seem endless and I am enthusiastic about getting started. I plan on teaching in Lexington beginning in the Fall of 2004. In the near future, I also plan on returning to school and earning a masters degree. I have yet to decide specifically what I want to study for my masters; I am waiting to see where my career leads me. I know now that having the background in education will provide many career opportunities in the future. Working with technology for two years has helped me to see how education is integrated into every career field.

My experiences as an educator in the world of computer science have been extremely beneficial to my future. Although it was a job, it was a job with a future and great impacts on my career. In fact, I cannot think of another area I could have been involved with as an undergraduate that could have influenced my life as much as working in the Computer Science department. I plan on using my experiences in the DMN lab to the fullest extent possible in the classroom. I will apply what I learned to influence children and the type of learning that occurs in my classroom. I want my students to value technology and learn how it applies to their own lives and understand how it can enhance their educations. Incorporating technology into the reading, writing, math, social studies, science, art, and music curriculums will allow students to learn and express themselves in a whole new dimension. I know now that I can be a leader in the use of technology and not follow the fear that is often associated with it. I want my students to leave elementary school with confidence to excel in the areas of technology and I feel that I can guide them on this path.

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Figure 1. Original image



Figure 2. Image after chromakey



Figure 3. Damaged sculpture



Figure 4. Final, "repaired" image



Figure 7. Digital, projected museum image



Figure 8. Virtual museum