Using Digital Media to Teach Computer Literacy

Project Proposal

by Sarah Wheeler

ABSTRACT

In the year 2008, computers are everywhere. They are on our desks, sure, but they are also in our cars, in our phones, in our music players, at the gas station and the supermarket and the bank, collecting, storing, and outputting information to us, for us, and about us. With such a high level of technology surrounding us every day, an outsider might assume that we all, as users and beneficiaries of this technology, have an intimate understanding of how and why it all works. They would be surprised to learn, however, that that is not the case. Unfortunately, a vast majority of the people who use, work with, and enjoy the benefits of computers every day have very little understanding of how they work. And this is a fact that needs to change.

Without a basic understanding of how a computer works, many individuals can be tempted to see it as a "magic box," fearing the intelligence that it appears to have, or expecting it to have capabilities that it can not have. I believe that the spread of computer literacy is vital to the future of technological advancement, therefore, my thesis project will focus on harnessing the power and prevalence of digital media to create a comprehensive media experience for teaching computer literacy. Through the use of the web, 3D modeling and animation, and an interactive Flash platform, my goal is to create an educational site that will guide users through the basic elements and functions of a computer so that, in the end, they will have a better understanding of these machines that are so prevalent in their everyday lives.

INTRODUCTION

What is Computer Literacy?

In our contemporary world, in the year 2008, it is very difficult for anyone to go through their day without using a computer in some way. This new form of technology has become so ever-present that we often do not even notice all the ways in which computers influence our lives. Computers are everywhere, not just in our houses and at our offices, but in our cars and our phones, at our banks and our grocery stores, controlling our traffic lights and our power grids. Computers come in all sizes, large and small, and they are an increasingly common fixture in our environment, to the point that people are becoming more complacent to the presence of computers in their lives without becoming any more knowledgeable about how they work. As the basic components of a computer – the silicon chips, the binary inputs and outputs, the electrical impulses – are further removed from people's vision of the computer – the desktop box with a screen and a pretty graphic interface – computer users are less likely to view the computer as a tool that helps them accomplish tasks and more likely to view it as a “magic box” that has an intelligence of its own. Even more advanced computer users who have mastered the computer interface and can perform complex tasks with the computer often do not realize how complicated the internal workings of the computer really are.

For the purpose of this project, computer literacy is defined as a spectrum of knowledge about the internal workings of a computer, ranging from a basic understanding of each of the hardware components, to a more in-depth look into the specifications of each piece of hardware and how each one affects the computer's overall performance, to a broad-to-deep discussion of the software interface and how code works in conjunction with the hardware components to perform the many tasks for which we use computers on a regular basis. This broad definition of computer literacy is necessary in order to accommodate several different types of computer users; those that have a basic understanding of how to use a computer but would like to know how it really works, those who have an advanced

understanding of computers and desire knowledge about its performance capabilities in order to make the right decisions when performing complex tasks, and those who are involved in creating basic programs or interfaces for computers and could use a greater knowledge of how their programs or surface-level code interacts with the root components of the machine. These three distinct types of users cover a wide spectrum of people who are capable computer users, but whose views concerning their use and effectiveness could be greatly expanded through knowledge of what computers are, rather than just what they can do.

Why is Computer Literacy Important?

In his article, “Why the Digital Computer is Dead,” author Chris Cheshire argues that computers should be renamed “invocational media” because the digital and computative qualities of a computer are no longer important to its users. He believes that since most people use their personal computers for viewing, listening to, and interacting with different forms of media, that the machine needs to have a name more in line with people's expectations for it. He wants to discard the term “digital computer” simply because the personal computers we use every day no longer exhibit the same qualities of early digital computers, which gained the name as a result of the fact that they stored all data in binary numeric form (the term “digital” as it relates to computers means something expressed in numeric form), and that their primary function was as a computation device for mathematical data. It took many layers of computer languages to even give the computer a visual interface, and even more to bring us the sleek, visually appealing programs we have today, but we cannot discard the term “computer” just yet, because at its most basic level, the digital computer is still the same machine, still making mathematical computations and still sending and receiving data as a series of ones and zeros. If we forget that the computer is just a tool programmed with information by human beings, then we may start ascribing power and personality to a device that we created, and at that point we no longer have

control over the technology, it has control over us.

The other problem with a lack of basic knowledge about how computers function arises when people develop either a strong fear of computers or a complacency towards their use and prevalence in society. When a person is overly fearful of technology, he is more likely to erect strong and unnecessary barriers to its use and advancement without considering the benefits that such advancement can bring to society. Fear of technology also leads to fear of users of technology, as we can see in overarching assumptions by people of older generations that the Internet, video games, cell phones, and other modern technologies will cause young people to develop self-centered, anti-social, or criminal behaviors. On the flip side, there are many people out there for whom a lack of understanding about how computers work has lead to a sense of complacency concerning their widespread use and infiltration into everyday life. The complacent individual is one like Chesher, who wants to redefine computers by the way they are used by a certain group of people, forgetting that the digital computer is still alive and well in our government databases, our scientific laboratories, our household appliances, our cars, and any other piece of modern technology that has a digital component to it. The complacent individual uses a computer without realizing the effect that it has on their everyday life; they make no stand on computer issues, they do not concern themselves with computer privacy, they have no say on the wisdom of using RFID chips in passports, or government snooping into their emails because they do not see how it affects them. They stand on the opposite side of the fence from the overly fearful, questioning nothing about technology rather than questioning everything. Obviously, a healthy medium lies somewhere in the middle, but the only way to bridge the gap is through an increase in computer literacy.

RESEARCH

Teaching and Learning with Computers

It is necessary to understand how people teach and learn with computers in order for an online interactive media environment to effectively get the message of computer literacy across to its users. Though methods of teaching and learning styles have been closely studied in regards to the traditional classroom setting, alternative teaching styles through media have often come and gone as fads, and therefore have not been rigorously studied. The majority of studies on teaching with media were done in regards to instructional videos and educational television programs for children, and the primary observation has been that the failing of such learning experiences is that watching a television is a principly passive activity. The student does not interact with the program in any meaningful way, and there is no reinforcement or feedback to ensure that the student understands the concepts being presented to him. Though an interactive computer program would solve many of the failings of televised learning experiences, the technology is too new, and the institution of traditional learning too well-tested for computer-based education to have progressed very far or studied in any real depth.

The one area in which computer-based learning is being tested, however, is in the field of adult distance education. There are numerous online colleges and degree programs that help adults receive or finish degrees online so that they can better fit their studies into their busy work lives, without having to travel to a school or take classes only on weekends or late at night. These degree programs still take the basic approach of a traditional educational framework, where the teacher gives lectures and posts assignments, and the students ask questions, take tests, and turn in assignments, but it is all done online through specially-designed interfaces that allow students and teachers to chat online, collaborate on assignments through file-sharing systems, and lectures to be given in either an audio or a text format that the student can read or play back at her leisure and based on whether she learns better by reading the notes or listening to them.

Though this project is designed as a single online "lesson," as it were, and not as a course on computer literacy, there will not be any student-teacher feedback through the media interface. However, by focusing on the fact that many adults, at whom this project is targeted, already look to the Internet when they want to enhance their understanding in a specific field of study, and using the knowledge that adults have a much better grasp of what they want to learn when they go searching for information, I can design a media program that enhances its ability to teach by tapping into the self-directed nature of adult learning. By answering a series of questions before delving into the interactive program, the user will be able to indicate their learning style, their desired starting point, and how much information they would like to know, which will allow them to get exactly what they want to learn about computers out of a very comprehensive program. A series of follow-up questions about their experience will reinforce the knowledge that they gained, as well as add to the overall understanding of the effectiveness of interactive computer programs as a teaching tool.

DESIGN

Interface

It is important for this project to be implemented in an online format because that will result in the greatest availability for the average computer user. An online implementation will also allow the user data concerning the website's effectiveness as a teaching tool to be collected and sent back to me for storage and possible analysis at a later date, though the results of that data are not a critical part of this project. As a result of this necessary implementation, there are several important factors to be considered in the realm of website access and usability.

The first is layout. The website will be designed using W3C standards-compliant HTML and CSS code, and it will include an obvious and easy-to-use menu and navigation system, a readable series of colors and fonts, and a final layout tested in all the major browsers, including Internet Explorer, Firefox, and Safari.

The interactive media environment itself will be implemented in Flash, as this is the most common plug-in for interactive demos and games online. However, it is understood that people coming to this website may not all be interested in learning about computers through an interactive environment, so the website will also contain a text-based walkthrough of the program, complete will still images from the program to illustrate the components and their functions, and there will be a video walkthrough for people who learn visually and audibly rather than by reading that will cover the same information with animated graphics. These two elements will be accessible through the front page of the site, but they can also be chosen as options for people taking the preliminary survey that will determine the starting point and level of information that they desire before interfacing with the interactive media experience.

The Surveys

There will be two surveys that users will be able to fill out over the course of their interaction with the site. The first one will come up right before they start the interactive media experience, and it will ask them some basic questions concerning their knowledge of computers, what they would like to learn from the interactive portion of the site, and how they would like to go about experiencing the media environment. There will only be a few questions on the first survey that will be required, in order to trigger the correct starting point in the interactive experience, so that returning users do not have to fill out the same survey over and over, but it is expected that first-time users of the site will fill out the entire survey in order to get the most out of the interactive portion of the site.

The second survey will appear after the user has exited the interactive media experience, and it will be a series of questions designed to reinforce what they learned from the site and how effective they considered the presentation of the information to be. This final survey will be completely optional, but the purpose of it will be explained so that people will know of its usefulness both to them and to the furtherance of understanding about teaching through computers, which may make them more inclined to fill it out. All information from this survey will be sent off and collected as data in order to further understand the merits and flaws of learning certain concepts through computer programs, in hopes of using this information to influence my work on future computer-based games and programs.

The Interactive Media Experience

The center of this entire project is the interactive media experience, which, in order to best teach computer literacy, will consist of a digital recreation of a standard PC desktop computer. Users will either be guided through the computer or be able to choose specific components that they want to look at based on their desires as expressed in the preliminary survey. At each major component, text and audio will pop up that will explain the primary function of that piece, how it works, and how it

connects to the other components and the software to make a functioning machine. Users will have the option to get more information about each piece, including product specifications, how it's made, and how that component is similar or different to its counterparts in laptops and Apple computers. They will also have the opportunity to remove the piece from the computer case and view it in three dimensions, with a reminder to put it back before moving on. This functionality stresses a hands-on approach in order to remove the fear of computers as complicated and easily broken machines, which in turn will encourage users to look inside their own computers without worrying about not knowing what each piece of hardware looks like or where it goes.

In addition to looking inside the computer tower, users will also be able to look inside the monitor at the computer's operating system, which will teach them about the functionality of computer programs, how they are coded, and the different computer languages and levels of languages that allow those programs to interact will all the hardware in the tower. The same options will be available to users here, with the ability to find out basic information, look deeper into each description, and compare the operation of different types of computers. Users can also either be guided through this section, or pick and choose what to look at at their leisure, depending on their preference.

This entire project is designed not only to teach people about how computers work, but also to make them comfortable with the computer as a machine and as a fixture in their lives. It is directed towards adults rather than children because adults generally fear messing with expensive pieces of technology when they do not know how they work, whereas children and their natural curiosity overcome that fear much more easily. The best way to truly understand computers, in my opinion, is to tinker, but I realize that for many people, tinkering with an expensive piece of electronics that they know nothing about is simply not an option. Therefore, by being able to play around with a virtual representation of that object, as well as being able to learn about each piece and how it works in the process, should help to alleviate that fear and instill a greater understanding of computers in anyone who chooses to go through this interactive media experience.

LITERATURE AND MEDIA REVIEW

My thesis project is designed to address two issues crucial to the advancing use of computers and digital media in our everyday lives: how computers can be used as effective educational tools, and why computer literacy, or an understanding of the internal workings of a computer, is necessary knowledge for people who use computers on a regular basis. The purpose of my project is to design an effective educational environment through which people can enhance their knowledge of computers, so the basis of my research looks into what is known about teaching with computers, as well as what individuals need to know in order to be computer literate and why it is important for them to have that knowledge.

Research on learning through different forms of media goes back to the dawn of film, with instructional and historical films being made for classrooms as early as 1911, when Thomas Edison released a series of historical films about the American Revolution as part of his participation in the Chautauqua adult educational movement. Thomas Edison and others were deeply involved in the study of learning through visual instruction, and their interest greatly influenced the educational film movement, which was picked up by the military and used as a staple of military training in both World War 1 and World War 2. After World War 2 ended, a new resurgence of interest in the effects of educational film use in the classroom continued until the 1950s before suddenly ceasing to be studied. Since then, educational films have continued to be used in classrooms, educational television programs often appear on public broadcasting stations, and television, radio, and computers have all been used for distance learning and adult education, but few studies have been done on what makes any media-based educational program effective or ineffective.[1] As a result, very little is known about what could make computer-based educational programs more effective, and very few existing programs seem to be designed to break out of the traditional teaching modes and make full use of the computer's capabilities as a dynamic, malleable, programmable teaching tool.

The stated concern with the use of past media such as movies, television, and radio is that such technologies present a uni-directional approach to learning. They are static and informative, students can not ask questions of a video or audio program, and it cannot respond to their questions or change its content based on their level of interest.[1] A computer, however, if programmed correctly, does have these capabilities, and it can also be used as a tool of communication between a teacher and her students, a fact which has led to a great increase in the availability and popularity of distance learning programs for working adults seeking college degrees or further training and instruction in a certain field of study. By researching current learning theories, several different ways in which computers can effectively participate in the learning process come to light.

The constructivist learning theory emphasizes the idea that students learn best when they are given situations in which they must question, experiment, and discover facts and relationships for themselves, rather than being handed the information in a pedagogical fashion. It emphasizes the idea of individual over group learning, and has been one of the greatest influences on the current standards of educational software design.[1] Interactive learning environments that allow for personalized self-discovery are one of the things that computers do best, but such environments have difficulty addressing the concerns of other educational theorists who have found that cooperative and social learning can be equally important as self-discovery and independent learning. Some educators are concerned about the ability of computers to isolate students from their classmates, and reinforce the traditional classroom discouragement towards working together to find answers to problems and to reinforce their understanding of a topic. We know through Internet-based social networking sites and the study of collective intelligence online that such collaboration is possible, and it would not be difficult to program educational software to allow networked collaboration and group work within a classroom. Web-based programs such as Blackboard are in the preliminary stages of just such a form of collaboration, with their online discussion boards, email clients, online calendars, and teacher-to-student interface that allows information to be passed back and forth in an online format, but most of

the information sent around a classroom through a site like Blackboard is static. The addition of video chat, dynamic discussion boards, a customizable user interface, and the ability for students and teachers to work together on digital projects and assignments over an online interface would bring a whole new level of interactivity and collaboration to educational networking sites, building off of the social model while still allowing for the intimate and pedagogical relationship between a teacher and student that many students benefit from.

The above learning theories have all been designed mostly through studies of children and young students, so it is not surprising that there are several differences when it comes to studying adult learning theory. One of the most significant differences is the additional concept of self-regulated learning, which is vital to educational practices in college and beyond. Adult learners, it is thought, should be given the chance to determine their own learning style and direction, and to be encouraged to discover this awareness through self-reflection of learning goals and outcomes. Those who have studied adult learning theory have also found that adults can more immediately apply what they learn, are more problem-centered rather than information-centered, and have very different motivations, goals, and expectations when they choose to further their education. Thus, teaching tools developed for adult learners should focus on developing inquiry skills and reinforcing self-directed learning.[1] The prevalence of distance education through online courses for adults has resulted in a variety of successful elements for computer-based educational programs: they should help develop critical thinking skills, allow for customization based on student interests, involve some form of human interaction, accommodate student collaboration and people with disabilities, and focus on performing real-life and complex tasks using drills for memorization.[2] Programs designed for adult education should also provide multiple ways of accessing and working with information, allow for multiple methods of navigation, encourage self-directed learning through the formation and testing of hypotheses, and encourage self-reflection on the learning process through some sort of progress-tracker. If such a learning program is located online, it should also be backed up by credible sources, be

easy to use and navigate, and be unique in its approach to the subject matter.[3]

When designing my project, I plan to take many of these approaches and learning theories into account. The project will be interactive and dynamic, allowing users to choose their starting point and the depth to which they wish to learn about each computer component. Since this program is not designed specifically to be used in a collective learning environment such as a classroom, there will be no collaborative elements inherent in its design, but the fact that it will be located online will allow users to interact with it in a collaborative setting if they so desire. My primary focus is on assisting adults in their understanding of the internal workings of computers, so my design will incorporate many of the elements of adult learning theory, specifically those of self-directed learning and self-awareness of their learning goals and outcomes. Before entering the interactive portion of the site, users will have a chance to fill out a preliminary survey designed to draw out their interest in what they are about to learn. It will ask questions such as "What do you know about how computers work," "What would you like to know about how computers work," and "What type of computer user are you," along with more detailed questions designed to determine their exact depth and breadth of knowledge about computers. This will give them an opportunity to concentrate on what they are about to study, which will increase their focus and knowledge-retention [1], as well as allow them to go directly to what they want to learn about the most. Then, when they exit the interactive portion of the site, they will have a chance to fill out a survey concerning what they learned and the effectiveness of the site, giving them a chance to reflect on their own experiences and the knowledge that they have gained. This reinforces both the self-directed learning approach and the process of self-reflection that is key to knowledge-retention in adult learners.

The interactive computer environment and the site design will also contain features in line with learning theory studies. The virtual computer from which users will learn about the internal workings of a computer will be completely interactive, and each element will contain several levels of information so that users can decide for themselves whether they want general explanations or more in-

depth knowledge given to them. There will also be several different ways of navigating through the interactive piece, a self-guided tour, a video with voice-over and text explanations, or a point-and-click interface, all chosen by the user's preference before entering the interactive space. Additionally, there will be a text-based walkthrough page with static pictures and information for people who learn textually or do not wish to use the interactive interface. All of these aspects, combined with a clear page layout, information on the basis of this project and its educational credentials, and a method for user feedback on the effectiveness of each aspect of the project will not only create a stable and effective interactive learning experience, but will also bring more information into the body of knowledge concerning the educational impact of information presented through interactive media.

The next aspect of my project that must be addressed is why I chose to focus on computer literacy, and how I am defining computer literacy for the purpose of this project. Computer literacy means many things to many people, usually depending on their own level of computer experience. For most individuals, computer literacy means being able to use a computer – understanding how to turn it on, how to use the keyboard and mouse, how to type and print documents, watch videos and listen to music, or browse the Internet. People who have more experience with computers generally expect others to know more as well in order to be proficient. For computer professionals, computer literacy for the general public means a slightly deeper understanding – knowing what the basic components of a computer are, how they work, what the operating system is, a basic understanding of how programs and programming languages work, and how to diagnose the most basic problems that they may run across while using a computer.[4] Others define computer literacy as achieving an understanding of thinking, how a material element such as a computer can assist in thinking, and then being able to work together with that machine to attain a higher level of intelligence.[1]

If a computer is just a machine, however, why should it be so important to know how it works in order to use it? Most people don't know all the internal workings of a car, and they don't have to in order to drive it. In the same way, one does not need to know how the computer really works in order

to be able to use it. The critical difference is that computers represent the baseline of a new technology. Technologies with which we are socially and culturally familiar, such as cars, televisions, radios, and telephones, can be classified as “mundane” technologies.[5] We understand these technologies: even if each individual does not have a deep familiarity with their inner workings, we all know that cars have engines and that certain levels of horsepower or miles per gallon are better than others, we have no deep fears about the technical capabilities of our televisions, and we understand these technologies to the point that more advanced iterations of them (cell phones, HDTV, etc.) are easily accepted into society without too many problems. The computer is a brand-new first-generation technology; just like the first car, telephone, or television, it is a mundane technology whose future iterations will have great social impact. However, because the speed of technological advancement has increased rapidly since the introduction of other mundane technologies like cars and telephones, the computer sits on a unique straddle-point between a mundane technology and an “exotic” technology, or one whose place in our culture has not yet been found and whose social impact has not been clearly defined.

Mundane technologies are called as such because they often become invisible to the people using them, but their presence still has an impact on everyday life and the cultural shaping of individuals. Computers have become a mundane technology in the fact that they have so easily insinuated themselves into our society and culture that many people have had their personal habits, cultural standing, and place in society impacted by the existence of this machine, but it remains an exotic technology as long as people continue to concern themselves not with the social impacts of its use but with its technological capabilities. The mystery has to be taken out of the technology of computers, people need to develop an awareness of a computer's capabilities as a unique technology so that they can begin to assimilate that knowledge into an understanding of how future computers will shape our society. When one is worried about the impact of computers from a position of ignorance, one's decisions concerning computer-derived technologies, or other social issues related to computers are based on incomplete and incorrect assumptions about their technological capabilities, and these

fears can be easily exploited and preyed upon by the more technologically-knowledgeable. However, if one comes to issues surrounding computers and their derivative technologies from a position of understanding, then they will be able to make well-informed decisions about future iterations of the technology and they will have a say in deciding how this new mundane technology will shape the society that has embraced it.

A basic understanding of the inner workings of a computer can be useful for almost anyone. For the basic user, it can give them a better sense of the computer as a machine, so that they are not as easily confused by errors or have as much difficulty accomplishing basic tasks due to misconceptions about how a computer works. For the slightly more advanced user, an understanding of the computer's components can help them choose the optimal configuration for a new machine, can assist them in minor hardware upgrades, and can help them perform more complex tasks with greater success by giving them a sense of the capacities and capabilities of their hardware configurations. The best outcome of an understanding of how a computer works, though, is the removal of fear. So many computer users, both basic and advanced, look at a computer and see a very complex and very expensive piece of technology. If the mystery is revealed, and the basic functions of a computer understood, and if people are taught to seek out knowledge about computers and how they work rather than simply learning computer tasks by rote memorization, the fear that comes from a lack of understanding will disappear.[4] This is the definition of computer literacy that I am basing my ideas upon – users becoming comfortable with the technology to the point that they are willing to find things out on their own and are no longer paralyzed by the complexity of the technology.

The threshold at which users becomes comfortable enough with a technology to be considered computer literate is not the same for everyone, and most computer users still in that state of fear concerning the technology are too afraid of breaking something to actually open up their computers and look inside. This is where the interactive media environment of a computer simulation comes into play. Though all computers look different on the outside, and though they all have different software

capabilities, and though there are different operating systems and companies that make computers, every computer, whether Windows, Mac, or Linux, has the exact same physical components. An understanding of how the processor, or the RAM, or the hard drives, or the video card work is a universal knowledge, regardless of the type of computer one has. And the creation of an interactive environment, in which users can explore each component of the computer without any concern over breaking their own monetary investment, encourages tinkering, which is the first step to removing the fear over how the technology works. I want my project to enhance computer literacy in a unique and user-friendly way, encouraging learning and tinkering, allowing users to choose their exact thresholds of understanding, while still providing an effective teaching tool that uses the diverse capabilities of the computer to help people understand all of the diverse capabilities of the computer. This knowledge, once out onto the web, will also be a starting point for discussions on the importance of computer literacy, in the hopes that people who come for the knowledge base will come away with not just a greater understanding of computers, but also with a greater understanding about why knowledge of computers is so important not just to individuals, but to society as a whole. The possibilities of computer technology are at the crux of many social, cultural, and governmental discussions today, and the only way for us as a society to make informed decisions about the future of computer technology is to understand how our current computer technologies work, and to be comfortable with them as unique yet mundane machines.

OUTLINE AND TIMELINE

Fall 2007

- Do project research
- Submit initial proposal
- Begin design of website
- Begin writing outline for information to go into interactive component
- Get project advisor

Winter 2008

- Finalize project proposal and submit to graduate committee
- Begin designing virtual computer
- Decide on best program to use for interactive component (preliminary decision is Flash, but that may need to be changed)
- Finish site design
- Create and test preliminary and final surveys
- Set up a database or email server to receive completed surveys
- Revise any specific components or design issues based on committee and advisor feedback

Spring 2008

- Complete interactive media experience
- Deploy interactive component and test entire website online
- Create text-based and video-based walkthrough based on elements from interactive component

- Make any final changes and do troubleshooting on website and media
- Present final project to the Graduate Committee
- Receive feedback and make changes
- Complete post-project analysis
- Receive final grade
- Graduate! ;)

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