Promoting Excellence in Preparation and Excellence in Practice

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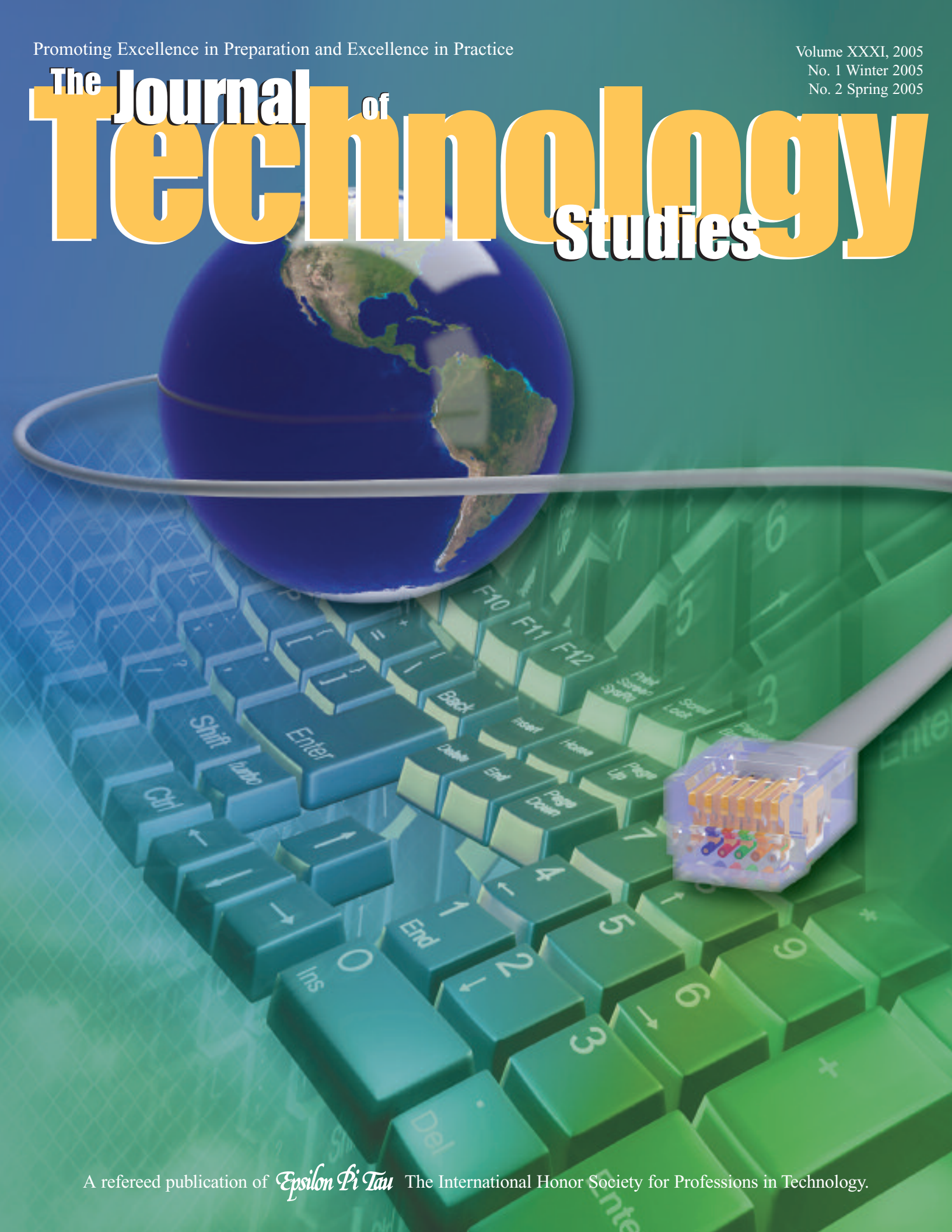

A refereed publication of Epsilon Pi Tau The International Honor Society for Professions in Technology.

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The Journal of Technology Studies

Articles

Providing a Virtual Initiation for Epsilon Pi Tau

Craig S. Sanders and Kathryn M. Griffin

Introduction

One of the requirements of the Epsilon Pi Tau (EPT) initiation is the apprentice has to physically be at the initiation (EPT, 2004). Since the majority of nontraditional students and working professionals are physically removed from an initiation site, they have missed the opportunity to join EPT.

Distance education in technological fields is continuing to grow to meet the needs of students and working professionals that are unable to attend traditional, on campus classes. Just as instructors can reach out to distance education students through the use of multimedia technology, so must organizations reach out to those same students. A key question, how societies can reach out and embrace nontraditional students, can be answered through the use of multimedia tools. By using the multimedia tools from the classroom in the initiation, nontraditional students and working professionals are now able to have the opportunity to participate in a live ceremony and experience the common social bond that develops in an interactive environment

The initiation itself consists of lessons with members of a ceremonial team playing the role of teachers/advisors. The lessons teach the apprentices about the organization, its fundamental beginning, basic beliefs and values, and the value and strength of the three precepts of EPT: technology, skill, and professional ideals. Therefore, it is very appropriate that one multimedia tool, streaming video, which is used in the classroom should also be used to teach the lessons of EPT.

On 8 April, 2005, the Beta Mu Chapter of The International Honor Society for Professions in Technology at East Carolina University (ECU) performed the first virtual initiation for the honorary in technology. Members of the ECU initiation team performed a face-to-face initiation for eight new apprentices while simultaneously initiating twenty more apprentices through the Internet using streaming video and an Internet relay chat client (mIRC). When the apprentices were required to respond to questions during the ceremony, the face-to-face group did so verbally while the students watching and listening on the Internet responded with a real-time, typed and transmitted text message.

This paper shows the benefits that schools and EPT Chapters can realize using a common and affordable Internet technology application to increase student participation and achievement, and provide EPT membership to deserving individuals who are geographically separated from traditional initiation sites.

The Value of Streaming Video

Streaming media technology distributes a real-time or on-demand combination of audio, video and multimedia via the Internet. Streaming media provides a simultaneous transfer of digital media so that it is received as a continuous real-time stream. Streaming video can deliver live or archived instructional presentations to all types of students, regardless of their available bandwidth. It is a series of compressed images that is sent in a continuous data stream over the Internet to a user's computer; the user can then view the images, or video, with only a short, few-seconds delay of buffer time. Streaming video replaces the downloaded video file, which can absorb massive amounts of computer memory and take a long time to download. Streaming video allows the user to start watching the video at almost the exact moment the data arrives on his or her computer (Waggoner, 2000). The great advantage streaming video has over other types of archived movies is that it does not leave behind a physical file on the viewer's machine; therefore, the speed or bandwidth of the Internet provider is less of a factor.

Streaming video has other benefits; it can be retrieved using broadband or dialup, is fairly easy to use, and is becoming less expensive each year (Cofield, 2004). Video streaming in the workplace is quite common now, covering issues such as diversity, safety, stress and time management, employee development and training, and total quality management. More people are realizing the benefits of streaming video in that it can bridge the gap between theory and practice. Traditional students, online students, and working professionals can now all have access to videos showing real-world problems, laboratory simulations, and lectures.

Overcoming Obstacles

While there are currently many obstacles to overcome regarding the adoption of video technology, there are also ways around these obstacles. Bandwidth refers to the amount of data that can be transmitted over the Internet in a fixed amount of time. For computing purposes, bandwidth is usually expressed in bits or bytes per second. Internet connection speeds include dial-up modems at 56 Kilobits per second (Kbps), DSL, which can range from 128 Kbps to 8 Megabits per second (Mbps), and T-1 lines at 1.544 Mbps. Generally speaking, the broader the bandwidth, the better the quality of the streaming video and audio. Many schools and students currently do not have sufficient bandwidth to support dependable downloaded video files, though the technology is coming.

According to one study, students who received instruction incorporating the video-on-demand application showed dramatic improvement in achievement (Boster, Meyer, Roberto, & Inge, 2002).

Potential advantages to multimedia are numerous. Claims ranging from reduced learning time to cost-effectiveness abound. Few of those advantages have been evaluated using formal experimentation, just as have the actual specific multimedia tools. One such tool, streaming video, has yet to be fully analyzed as a new instructional tool for both online and on campus classes; streaming video has the potential to bridge the divide between all types of students, and enhance material retention of said students.

Social Belongingness

Unfortunately, distance education does have its disadvantages, one of which is the lack of face-to-face social interaction. Online students are often cut off from campus activities and camaraderie with fellow students; the only form of interaction is through multimedia devices, which may enable visual interaction, but not physical interaction. Technology that is being used today in education has decreased face-to-face interaction and communication (Hagan, 1999). Online students often find themselves lacking in social presence, those qualities present when people are communicating and interacting in close physical proximity (Saenz, 2002).

This lack of physical interaction, or depersonalization, goes against human nature. Humans have basic needs, one of which is the need to belong. Maslow's hierarchy of needs show that one of the most fundamental biological needs is that of love and belongingness (1954). People seek relationships with and their places in formal, informal, and social groups. Numerous studies have been in agreement with Maslow's idea of belongingness (Mioduser, Nachmias, Lahav, & Oren, 2000; Ladyshewsky, 2004; Nohria, Lawrence, & Wilson, 2001; Ryan & Deci, 2000; and Thompson, Grace, & Cohen, 2001). Belonging to a group or a social set provides people with information and purpose, and gives them a foundation of social identity, including values, attitudes, and behavioral intentions (Haythornthwaite, 2002). Hence, many who are online are turning to virtual organizations and/or groups to satisfy their need to belong. The virtual groups give individuals a sense of affiliation and social satisfaction (Watson-Manheim, Crowston, & Chudoba, 2002; Dholakia, Bagozzi, & Pearo, 2004).

While Epsilon Pi Tau (EPT) is not necessarily categorized as a virtual organization, it does provide a means of emotional support, social support, companionship, and a sense of belongingness to its individuals. However, the organization has not been able to reach many distance education students because of students' location, work schedule, and other various issues.

Intitiation Methods

Two emails were sent out to East Carolina University distance education (DE) and on campus (OC) students nominated for membership into EPT. DE students are defined as nontraditional students who usually attend classes through the Internet, and typically have an age range of 25 to 65 years. OC students are defined as those students who usually attend on campus classes, and typically have an age range of 18 to 24 years.

For those students who accepted the nomination, a second email was sent with instructions concerning the initiation. The OC students received the traditional instructions, including the time and location of the initiation. The DE students received different instructions, which included the time of the initiation, instructions concerning the set up of mIRC, location and access to the streaming video website, and instructions on responding to the pledge statement. Both sets of instructions were also posted on the College of Technology and Computer Science website.

The initiation was held at ECU, and the following multimedia components were used: a 64-inch screen television, a web camera with remote movement capabilities, five microphones, a computer with a video capture card, software, a high bandwidth internet connection, video compression, mIRC, and Microsoft software.

The ritual itself was divided into an 84-slide PowerPoint presentation; a chapter member controlled the speed of the presentation by a remote mouse. The PowerPoint presentation was displayed upon the television, which acted as a teleprompter. The webcam was placed above the television so that when the presentation was read aloud, it appeared as if the initiation team members were looking straight into the camera, connecting with their audience. Three technicians controlled the broadcast, camera movements, audio and visual components, and the mIRC chatroom.

DE students were instructed to view the live streaming video broadcast through the Global Classroom website and, at the same time, be logged into a specific mIRC chat room, which kept logs of the conversation and the students who were in the chat room. An ECU moderator controlled the mIRC chat room. The moderator gave instructions at the beginning of the ceremony concerning chat room etiquette and the proper response during the pledge statement. During the pledge, DE students were asked to repeat the pledge in real time, and then type their names into the mIRC chat room as verification of completing the pledge. OC students followed the normal initiation procedures.

Conclusion

The Beta Mu Chapter members and the Region 2 Director, Robert E. Wenig, who attended and participated in the initiation, considered the initiation a success. An informal survey of attendees and initiates showed a very favorable response. As of yet there has been no formal response from the Board of Directors of Epsilon Pi Tau, but informally they are considering the virtual initiation for adoption as a way to reach more deserving nominees.

After an exhaustive search, it appears that EPT is possibly the first organization to ever attempt an online initiation ceremony, and has proven that it is a viable alternative. Using distance education technology tools, EPT can now extend membership to individuals who were once geographically incapable of physically attending an initiation, increasing interest and participation in EPT activities and membership.

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Articles

An Exploration of Middle and High School Students' Perceptions of Deviant Behavior When Using Computers and the Internet

Annie J. Daniel

Abstract

If the current trend continues, the use of computer technologies and the Internet will increase for teaching and education. It is urgent that researchers study computer and Internet deviance. The purpose of this study was to explore middle and high school students' perceptions of deviant behavior when using computers and the Internet.

The target population for this study was middle and high school students. The accessible population included all students who attended a middle or high school in the East Baton Rouge Parish School, which has computers that are capable of accessing the Internet (1,150 students - 575 middle school students and 575 high school students).

Professor San-Yi Li of Taiwan designed the instrument used in this study. This instrument contained 66 questions and a scantron was used to record participants' responses. From the instrument, variables were selected from five sections - 1) students demographic characteristics 2) computer-related activities 3) students perceptions of deviant behavior when using computers and the Internet 4) students perception of their peers deviant behavior when using computers and the Internet 5) students ability to use computers and the Internet.

Results showed that the majority of students indicated they perceive their behavior as being not deviant when using computers and the Internet. Contrarily, the students indicated they perceive the behavior of their peers to be more deviant when using computers and the Internet. When the means of the Students Behavior Score and the Peers Behavior Score were compared, there was a significant different between the two scores. The Peers Behavior Score for deviance was much higher than the Students Behavior Score.

Introduction

"Any technology tends to create a new human environment."

-Marshall McLuhan

Marshall McLuhan declared this quote over forty years ago. Indeed, today's technology has created many new human environments and behaviors. Deviant behaviors on the computer and the Internet are rising as technology use increases (Hollinger, 1996b; Power, 2000; Vatis, 2000). This is evident in the enormous number of computer viruses that have been released recently causing businesses, educational institutions and personal computer users to become skeptical about performing familiar daily tasks (e.g., opening email messages).

For the purpose of this paper, deviant behavior for technology will include these activities: using computers and the Internet for illegal activities that violate local, state, and/or federal laws, inappropriate use; such as, a violation of the intended use of the Internet or computer, and/or its intended purpose and goal, obscene activities; defined as entering a pornography website or selling pornography goods on the Internet; using the Internet or computer to violate copyrights laws or other contracts such as institutional or third party copyright, license agreements and other contracts, intentionally disrupting the Internet traffic by spreading a computer virus, spreading rumors about another person on the Internet, intimidating and frightening another person on the Internet.

Deviant behaviors are a genuine concern since our society is rapidly moving from a typographic culture to a post-typographic culture (Provenzo, Brett & McCloskey, 1999). According to Provenzo, et al., "typographic culture is defined as a culture or society based around the technology of printing and post-typographic culture is defined as an electronic non-text-oriented culture." (p. i) With this movement, our culture and society is being transformed. People are communicating more by electronic mail and computers than by text or letter writing. Culturally, we are becoming more

dependent on computers and computer-based technologies (Provenzo, et al.).

For example, students are no longer learning to type with typewriters, but with word processor software. Those schools that are using typewriters are rapidly moving into the post-typographical era. Graphing calculators are required in math courses. Digital cameras are being used in art courses. In addition, art teachers are integrating computers with computer aided drawing software to teach computer drawing or graphic design to students.

Moreover, computer technologies are used to enhance various everyday classroom activities. Students may engage their time by playing computer-generated video games, simulations, drills and practice exercises, or tutorials. When students make class presentations, often the presentations will be integrated with interactive multimedia technology. Integrating technology is well thought-out type of school reform that is used to improve the learning of all students; schools are moving rapidly to integrate computers and the Internet into their curriculum (Glennan & Melmed, 1996). Computers are considered a tool that when effectively used, will increase efficiency and productivity in a curriculum (Hunter, 1984). Researchers have designated the Internet as an equalizer of knowledge, because it allows the same knowledge to be accessible to all (Kearsley, 2000; Kent & McNergney, 1999; Milken Family Foundation, 1997; Papert, 1993). The cost of purchasing a computer has drastically declined in recent years. This decline in costs is allowing the Internet and computers to be more accessible to all by being available in public libraries and schools. In addition, this decrease in the cost of computers allows more of the United States' population to own personal computers.

Brief Overview of Technology Deviance

For the past ten years, the Internet and computers have radically changed the way schools interrelate with the world. The information super highway has become a reality. Students can use the Internet from home or school to travel vicariously all over the world, to gather information and new knowledge. As more travel on this electronic highway increases, maps to find information and rules to keep the journey safe is becoming vital to successfully completing the journey.

In Understanding Media, Marshall McLuhan (1964) stated the following:

> Any technology tends to create a new human environment. Script and papyrus created the social environment we think of in connection with the empires of the ancient world. The stirrup and the wheel created unique environments of enormous scope. Technology environments are not merely passive containers of people but are active processes that reshapes people and other technologies alike. In our time, the sudden shift from the mechanical technology to the electric circuitry represents one of the major shifts of historical time. (p. iv)

Marshall McLuhan predicted in 1962 a coming "Global Village." This global village is now reality, in the form of the Internet. His words are so prophetic, "Technology environments are not merely passive containers of people but are active processes that reshape people and other technologies alike" (p. 2). Due to the evolution of the Internet and computers, this very quotation is now reality. Computers and the Internet have "reshaped people and other technologies alike" (p. 2).

As our society is being transformed, computers and the Internet are being incorporated into almost every activity including education, communication, shopping, buying and selling goods, and business. In business, having a website and electronic address in order to show that your company is on the cutting edge of technology is important. Large corporations and small locally owned companies are on-line. Being on the Internet is a new way of attracting potential business. The education system has the same views about technology, having technology in the schools shows willingness for reform or improvement. With change and improvement, usually there are advantages and disadvantages that should be considered. One major disadvantage is that computers and the Internet are vulnerable to attacks and sabotage.

Voss (2000) referred to the Internet as "cyberworld," which is very much like our earthly world. It has highways (the World Wide Web), businesses (e-commerce), homes (homepages), schools, colleges, universities (distance learning), and it has people that travel in this world (by way of the Internet). Among these people, there are those that are deviant and

commit deviant acts on the superhighway and in cyberworld, but there are no police, highway patrol officers, and administrators of discipline or cybercops to stop these people from committing their deviant acts, although authorities are beginning to pursue actively such criminals (Power, 2000). This research will focus on what young people (middle and high school students) perceive to be a deviant act when using a computer or the Internet. After all, some of these students have been using computers since the age of two (National Public Radio, 2000).

The Internet is the electronic highway that provides a means of instantly accessing people, institutions, and an overwhelming amount of information from around the world.

Basically, the Internet is the world's largest computer network linking millions of people in more than 50 countries, on every continent of the globe. Most of the services are provided free by organizations that support host computers on the network. These typically include universities, corporations, governments, and small businesses that use mainframes and mini- computers to maintain and manipulate databases.

Due to the easy access of information on the Internet; the opportunity for misuse increases. Ethical behaviors by students, teachers, employees, and employers have become a major topic of concern. With the frequency of technology use, cyberattacks are also on the rise (Hollinger, 1996b; Power, 2000), as well as the question of ethical behavior by students and employees. A recent report on Cybercrime by Michael A. Vatis (2000) Director, National Infrastructure Protection Center, Federal Bureau of Investigation, indicated that cybercrime is on the rise:

> As Internet use continues to soar, cybercrime is also increasing exponentially. Our caseload reflects this growth. In FY 1998, we opened 547 computer intrusion cases; in FY 1999, that number jumped to 1154. Similarly, the number of pending cases increased from 206 at the end of FY 1997, to 601 at the end of FY 1998, to 834 at the end of FY 99, and to over 900 currently. These statistics include only computer intrusion cases, and do not account for computer-facilitated crimes such as Internet fraud, child pornography, or e-mail extortion efforts. In these cases, the NIPC and NIPCI squads often provide technical assistance to traditional investigative programs responsible for these categories of crime. (p. 12)

Secondary and college faculty have reported an increase in students cheating by computer (Benning, 1998). According to a George Mason University instructor, cheating is more easily done by using computers and the Internet. Anne Marchant (a college instructor) refers to these types of cheaters as "patchwork plagiarists." She says, "The students who copy and paste together passages from various articles they have found on the Internet, then turn in the work as their own." (p. 1). She teaches computer science and catches at least one such student every semester and this includes students using plagiarism in her computer ethics course. Marchant says she has no problem identifying the cheater, because "It's usually deadly obvious. The introduction will be written in broken English; then it will have this flawlessly written, almost doctoral-quality body; and then a conclusion that goes back to broken English." (p. 1) Students have access to dozens of web sites that aid them in cheating (on-line paper mills sell term papers) and students share tests and course materials via email or diskette (Benning, 1998).

In addition to using computers and the Internet to cheat, a few studies have been conducted to determine the types of on-line activities at colleges. Perry, Wilkinson, and Perry (1998) surveyed 509 college students to determine how many students engaged in seven on-line activities. There was only one question that addressed deviant behavior (Do you use the Internet to access adult material?); fifty (23%) of the 218 responded "yes" to this question.

Cost of Computer and Internet Deviance

The business industry is more susceptible and vulnerable to attacks (Power, 2000). Harrison (1999) reported that for the last three years, the Computer Security Institute statistics on cyberattacks showed a financial loss of more than $100 million a year. In Harrison's report, 521 security managers in the study reported breaches by outside crackers or hackers, and 30% of the respondents reported intrusions; which was up from 24% from the previous year. The Internet connection had the highest point of attack, 57% of the respondents. While 20% of the respondents had detected unauthorized

Table 1: Computer Crimes and Financial Loss

Types of Computer Crime	1997	1998	1999	2000
Theft of proprietary information	$20,048,000	$33,545,000	$42,496,000	$66,708,000
Financial fraud	$24,892,000	$11,239,000	$39,706,000	$55,996,000
Virus	$12,498,150	$7,874,000	$5,274,000	$29,171,700
Insider abuse of Net access	$1,006,750	$3,720,000	$7,576,000	$27,984,740
Sabotage of data or networks	$4,285,850	$2,142,000	$4,421,000	$27,148,000
Unauthorized insider access	$3,991,605	$50,565,000	$3,567,000	$22,554,500
Laptop theft	$6,132,200	$5,250,000	$13,038,000	$10,404,300
Denial of service	N/A	$2,787,000	$3,255,000	$8,247,500
System penetration by outsider	$2,911,700	$1,637,000	$2,885,000	$7,104,000
Active wiretapping	N/A	$245,000	$20,000	$5,000,000
Telecom fraud	$22,660,300	$17,256,000	$773,000	$4,028,000
Telecom eavesdropping	$1,181,000	$562,000	$765,000	$991,200
Spoofing	$512,000	N/A	N/A	N/A
Total Annual Losses:	$100,119,555	$136,822,000	$123,779,000	$265,586,240
Grand Total of Losses Reported (1997-2000): $626,306,795				

Source: Computer Security Institute - 2000; 643 Respondents for 2000

access or misuse of their websites in the past year from outsiders, 55% of the respondents reported attacks from the inside had increased by 10% from the previous year (Harrison, 1999).

For the past five years, the FBI and the Computer Security Institute have conducted a study of computer crime by administering the "Computer Crime and Security Survey" to information security professionals at corporations, financial institutions, government agencies, and universities across the United States.

The table shows the types of computer crime and amount of financial loss incurred over a period of four years by types of computer crimes. For several of the crimes, the financial losses have increased over the years of the study. The highest loss occurred in the 2000 survey (see Table 1) by theft of proprietary information ($66,708,000) and the lowest was telecom eavesdropping ($991,200).

A Review of Related Research on Students' Computer Usage

This review on related research was compiled from research of students in the United States. Researchers in the studies are from public and private institutions.

Where Students Use the Internet

According to a survey by the National School Boards Foundation (2000), "both school and home are important points of Internet access for children" and "by the time they are teenagers, nearly three out of four children are online." (p. 1)

Twenty-eight percent of the children surveyed by the National School Board Foundation (2001) reported that they access the Internet from home. However, when parents were surveyed, 69 percent of the parents reported their children have access to computers at home and are able to log onto the Internet.

Overall, 23 percent of all children surveyed are accessing the Internet from school. Fifty-six percent of parents whose children have access to the Internet at home reported that their children also log onto the Internet at schools or preschools. (p. 1)

Reasons Students Use Computers and the Internet

Researchers at the National Center for Educational Statistics (2000) revealed that the main reason families buy computers and connect to the Internet is for educational purposes.

> About two thirds (64 percent) of family households surveyed have a home computer. The most common reasons parents cite for buying home computers is children's education (36 percent) and business use (27 percent). Likewise, the most common motivation parents cite for their child to use the Internet from home is their education (45 percent). Education is the single most frequently cited motivation (39 percent) for parents who anticipate obtaining home Internet access as well, followed by email (17 percent) (p. 1).

Additionally, student ages 13 to 17, in the National School Board Foundation (2001) study, cited education and schoolwork (32 percent) as the main reasons for usage. This study also reports that students use the Internet at least once a week for schoolwork and general learning activities not connected to school.

Frequency of Computers and the Internet Use

The National Center for Education Statistics (1997) reported the frequency of computer and Internet use by students. This report disclosed information pertaining to students in the fourth, eighth and eleventh grades for five years (1984 to 1994). The categories for frequency of use were never, less than once a week, once a week, 2 or 3 times a week and every day.

Results of this study showed that in 1984 the majority of students in each grade level responded that they had never used a computer (4th grade-61.2%, 8th grade-66.7%, 11th grade-55.0%). However, by 1994, the majority of the students in all grades reported using a computer less than once a week, once a week, 2 or 3 times a week, or every day (4th grade-83.5%, 8th grade-72.4%, 11th grade-73.9%).

Computer use by students has increased over the years. Students are using computers at home and at school and using them for learning activities and pleasure (chatrooms, emails, playing games, listening to and recording music, etc.). (National Center for Education Statistics, 1997)

Computer Usage by Gender

In general, girls use computers and the Internet as much as boys, but in different ways (National School Boards Foundation, 2000). When it comes to competency, girls are as competent as boys. Girls are more likely to use the Internet to e-mail friends and family than boys. Girls are also more likely to use the Internet for schoolwork and chatrooms than boys. Boys reported using the Internet more for entertainment and games.

> According to their parents, 48 percent of 9- to 12-year-old boys and girls are online, while 71 percent of 13- to 17-year-old boys and girls are online. Both younger and older girls seem just as likely to use the Internet as their male counterparts; 50 percent of 9-to 12-year-old girls use the Internet, compared to 46 percent of boys. In the 13- to a 17-year-old age bracket, 73 percent of girls use the Internet, compared to 70 percent of boys. (National School Boards Foundation, 2000, p. 6)

Computer and Internet Use by Race and Income

"Schools have the opportunity to help narrow the gap between the haves and have-nots with Internet access." (National School Boards Foundation, 2000 p. 7) "Parents with an income of $70,000 or more reported that one or more of their children use the Internet, compared to 35 percent of parents with incomes of less than $40,000. Fifty-seven percent of white parents report that their children use the Internet, compared to 23 percent of African-American parents." (National School Boards Foundation, 2000, p. 7)

Among students with parents who have an income of $40,000 or less, 76 percent of 9-to 17-years-old use the Internet at school; while 68 percent of children of wealthy families and 54 percent of children in middle class families use the Internet at school. Schools are the main source of Internet use for children that are from low-income families (National Center for Education Statistics, 1999 & National Center for Education Statistics, 1998).

Eighty percent of African-American families with children age 9 to 17-years-old use the Internet at school. This is compared to only 16 percent who reported they log on from home (National School Boards Foundation, 2000 & National Center for Education Statistics, 1999).

This report is consistent with findings from a study by the National Public Radio (2000). Results of this study revealed a "digital divide" between those with lower incomes and less education. "Americans with lower incomes are less than half as likely as those with higher incomes to have an Internet connection at home" (p. 1). Furthermore, "there is a gap of 11 percentage points between blacks and whites using computers at work (46% vs. 57%); but there is a larger, 22 point gap between blacks and whites who have a computer at home (51% vs. 73%). Similarly, a gap of 8 points exists between blacks and whites using the Internet at work (21% vs. 29%) compared with a larger 19 point gap in access to the Internet or e-mail at home (38% vs. 57%). There is a 17 percentage point gap in home-computer ownership between low-income blacks and low-income whites" (p. 5).

The Study

If the current trend continues, the use of computer technologies and the Internet will increase for teaching and education. It is urgent that researchers study computer and Internet deviance that may occur in the educational environment. Although a limited amount of research has been performed to determine the types of deviant behavior students use on the Internet and on computers, the opportunity to perform deviant acts increases with the integration of technology in education.

Methodology

Population and Sample - The target population for this study was defined as middle and high school students. The accessible population included all students who attended a middle or high school in the East Baton Rouge Parish School System (EBRPSS) with computers that are capable of accessing the Internet. A convenience sample of approximately 1,150 students was surveyed (575 middle and 575 high school students). Principals at these schools were notified of the study and asked to identify teachers with Internet access in their classrooms. The school principals decided which teachers would participate in the study, which determined the students to survey.

Purpose and Objectives of the Study-The primary purpose of this study was to explore middle and high school students' perceptions of deviant behavior when using computers and the Internet. In order to answer the research problem, the following six objectives were used to guide the researcher:

1. Describe the middle and high school students on the following selected demographic characteristics: a) Gender, b) Age, c) Ethnicity, d) Grade in School, e) Type of School (middle or high school), f) Academic Achievement as Perceived by the Students, g) Religious Affiliation, h) Students' Interaction with Teachers, i) Students' Interaction with Other Students
2. Describe the middle and high school Students' Behavior Score.
3. Describe the middle and high school Students' Peers' Behavior Score.
4. Compare the Students' Behavior Score of middle and high school students on selected demographic characteristics and perceptions of computer-related activities.
5. Compare the Students' Behavior Score and the Peers' Behavior Score.
6. Determine if a relationship exists between the Students' Behavior Score and the Peers' Behavior Score on selected demographic characteristics and perceptions of computer-related activities.

Instrumentation and Procedure for Data Collection-The instrument for this study was developed by Professor San-Yi Li in Taiwan (who gave the researcher permission to use his instrument for this study) and revised by the researcher. Several key demographic questions were added to the survey, which were: "What is your race or ethnicity?," "Is there a working computer in the home where you live?," "If there is a working computer in the home where you live, is it connected to the Internet?," and "What type of school do you attend?" The original survey had 62 questions. After the revisions, the number of questions increased to 66. Not all of the questions were used for this study. Questions that addressed the objectives of the study were selected as variables to be used in the study. The selected variables were systematically copied into a file. The primary variables studied were categorized as: 1) students' demographic characteristics, 2) computer-related activities, 3) students' perceptions of deviant behavior when using computers and the Internet, 4) students' perception of their peers' deviant behavior when using computers and the Internet, and 5) students' ability to use

computers and the Internet.

Data were collected during the spring semester of 2000. The procedure for collecting the data was as follows:

1. The EBRPSS Director of Academic Accountability was contacted to obtain approval to conduct a research survey in the middle and high schools in the system.
2. The parish Director of Technology (was contacted by telephone and visited in person by the researcher to obtain the list of schools) identified the seven middle and seven high schools with computers that had access to the Internet.
3. Principals of the schools identified were then contacted by faxed letter and telephone and a request was made to survey students with computer and Internet usage experience.
4. Those teachers and students selected by the school principals were informed of the general objectives of the research by the principal and the researcher. Students were asked to participate in the study voluntarily.

Once the subjects agreed to participate in the research, they were informed that this project required them to complete a survey that consisting of 66 questions. Students were given a pencil and scantron sheet to record responses and an additional sheet with open-ended questions to respond to. Students were allowed about 45 minutes to complete the survey, but additional time was allowed for those students needing it. Five hundred seventy five middle school students and 575 high school students responded to the survey.

Summary of Findings

For the first objective of the study, participants were asked several questions that pertained to demographics, (e.g., age, ethnicity, grade level). Participants' ages ranged from 13 to 17 years old. As for ethnicity, the majority of the students responding reported their ethnicity as African American, with the next largest group of respondents being White. The grade level of the students ranged from 7th to 12th grade, with the 11th or 12th graders having the largest number of respondents. Students in the study were either in middle or in high school, and most of them rated their academic achievement as good with a strong religious affiliation. Additionally, a large portion of the students interacted with their classmates and teacher regularly.

Objective two was to describe the middle and high school Students' Deviant Behavior Score, which indicates how often a student perceives he/she is using deviant behavior when using the computer or Internet. According to the Students' Deviant Behavior Score, the majority, 869 (79.6%), of the responding students indicated that they displayed no deviance or some deviant behavior while using the Internet. Only a small percentage of students indicated deviance.

In addition to the students' score, students were asked to describe their peers' level of deviance. This data was collected by using the Peers' Behavior Score, which indicates how often a student perceives his/her classmate to be displaying deviant behavior when using the computer or Internet. The results of this score indicated that the majority (1,016, 81.5%) of the students perceived their classmates to be displaying deviant behavior often or very often when using the Internet and computers. The researcher believes that if the students' peers are engaging in this type of behavior than a larger number of students may be engaging as well, but are not disclosing this information. Apparently, students feel more comfortable disclosing what others are doing, rather than what they are doing.

Objective four compared the Students' Behavior Score on selected demographic characteristics and perceptions of computer-related activities, by using a Chi-square procedure to determine if a relationship existed. When comparing the Students' Behavior Score, the following findings were discovered about gender: males indicated displaying more deviance than females when using the Internet and computers. Results indicated a statistically significant relationship between gender and perceived deviance. It appears that males are more likely to display deviance when using the Internet and computers than females. The overall results showed that 27.9% of the males and 12.6% of the females reported deviance. There were twice as many males as females that reported deviance when using the Internet and computers.

When considering deviance and age, two age groups showed the lowest percentage of deviance while using computers and the Internet, the 13 and 17 year olds. Students ages 14, 15 and 16 had the largest percentage of deviance reported. Furthermore, in all of the age groups the majority of the students indicated that they did not display any deviance.

Additionally, the ethnic group indicating the largest percentage of deviance when using the Internet and computers were the Spanish/Hispanic students. The second largest percentage of students indicating some deviance was Asian students. This is comparable to a study by Hollinger (1996b) of college students. He researches crime by computer as it correlates with software piracy and unauthorized account access of college students. He reported that Asian and Hispanic students indicated the highest levels of piracy.

When reporting academic achievement, the majority of students reported their academic achievement as being good, and most of the students perceived themselves as displaying no deviance or some deviance when online. This test resulted in a significant relationship between academic achievement and Student Behavior Score. Students indicating poor or fair academic achievement reported the highest percentage of deviance. Of the students that reported "poor" achievement, 38.1% indicated deviance, and the students that reported "fair" achievement had 25.7% to indicate deviance compared to those students that indicated "good" (17%) or "excellent" (17.4) achievement.

For religious affiliation, those students that indicated a strong or very strong religious affiliation also had the largest percentage of students that did not display deviance when using computers and the Internet. Religious affiliation did not result in a statistically significant relationship with Student Behavior Score. When comparing the no religious affiliation with strong religious affiliation (the group that is closest in numbers), there is no significant difference. The researcher believes these students are either just honest because of their religious affiliation, or religious affiliation for some is not as effective as for others in developing ethics. After all, the students with no religious affiliations were able to admit what they are doing online.

With regard to students' interaction with teachers, most of the students indicated that they interacted with their teachers. Interacting with teachers did not have a significant relationship with the Student Behavior Score. Although there was not a significant difference between level of interaction with teachers and Students' Behavior Score, students that reported no interaction with teachers reported deviance at 26.3%. This is compared to the students who reported they interacted with their teachers "some" (15.9%), "often" (20.1%) and "very often" (22.5).

The students that interacted with other students reported the least amount of deviance when using computers and the Internet. The majority of the students indicated that they interacted with their classmates. Furthermore, there was a significant relationship between the Student Behavior Score and the level of interaction students have with their classmates. Students that reported no interaction with classmates had the highest overall percentage of deviance (35.2%). This is compared to the other levels of interaction that gets lower as the level of reported interaction get larger ["some" (21.8%), "often" (18%) and "very often" (17.4)]. Consequently, students that alienate themselves from others are engaging in more deviant activity when using computers and the Internet.

A high proportion of the students indicated that they spend "much" time online and display very little deviance when using the Internet and computers. This analysis was interesting because some of the students indicated that they do not spend any time online, but they displayed deviant behavior when online (time spent online "none," 28.6% of the students indicated deviance online). Students evidently misunderstood the question. Students' time spent online have a significant relationship with Students' Behavior Score. Students that reported spending more time online has the highest overall percentage of deviance -"very much" (22.2%) and "much" (21.2%). This is compared to the other students that reported spending less time online, "little" (15.5%).

As related to hours per day spent on the Internet, when asked specifically how many hours per day they spent on the Internet, students could relate to this question and responded more accurately. Hours spent online are highly related to Student Behavior Score. Students

that reported spending the least amount of time online reported the lowest percentage of deviance (2 hours, 15.3%). This is compared to the other amounts of time spent online, in which the percentage of deviance increases as more time is spent online (3-4 hours, 19.1%; 5-6 hours, 37.2%; 7-8 hours, 44.7%; 9 hours, 46.7%). It is highly recommended that students' time online is supervised and coupled with a program that will monitor or control their online activity.

When asked whether there was a working computer in the home, the majority of the students indicated that they had a working computer in the home. However, a smaller number of students indicated that they did not have a computer in the home. A working computer in the home was shown to be significantly related to the Student Behavior Score. The percentages for deviance were higher for those students not having a computer in the home. This relationship could mean that students do not need a computer in the home to engage in deviant acts on computers and the Internet.

Kevin Mitnick (one of the most famous computer hackers) did not own a computer, but he had been engaging in deviant acts with computer since he was a juvenile. Students with a working computer in the home may be more familiar with computers. Students may not realize or not have been taught that certain behaviors are deviant, therefore they may not be reporting their behaviors accurately. The significance may be how students with computers in the home view what is actually deviant behavior verses those without a computer in the home. Coldwell (1996) concluded that students from machine-based disciplines (computer environments) are less able to predict the social consequences of computer crime than those from people-based disciplines (no computers).

Due to the fact that students are being introduced to computers and the Internet at an earlier age, technology ethics needs to be introduced at all levels of education starting when computers are first introduced to the student. Having a computer in the home allows more chances of deviance to occur, despite the fact that a student may not realize what is happening. Therefore, supervision and ethics teaching become a necessity at home and away from home.

Objective five compared the Student Behavior Score and the Peers' Behavior Score. From the comparison of the means of the Peers' Behavior Score and the Students' Behavior Score, students' perceptions of themselves and their classmates are very different. Students perceive their peers are displaying deviant behavior "often" and "very often" on computers and the Internet. However, students perceive that they are not engaging in "deviance" or "some deviant" behavior.

The researcher believes that if the students' peers are engaging in this type of behavior, then a larger number of students is engaging as well, but is not disclosing this information. Students may feel more comfortable disclosing what others are doing. Students may not want to admit displaying deviance, but it is easier to be more open when discussing someone else's behavior. Therefore, the two scores can be used to gauge the amount of actual deviance being displayed.

The final objective examined whether or not a relationship existed between the Student Behavior Score and the Peers' Behavior Score on selected demographic and perceptual characteristics and computer-related activities. This analyses indicate that relationships are statistically significant between gender, hours spent on the computer, access to a computer with Internet, ethnicity and the ability to use the Internet for how students' perceive their peers' deviant behavior when using the computer and Internet. Likewise, results indicate that relationships exist between gender; hours per day spent online, access to a computer with Internet, ethnicity and a working computer in the home when examining how students perceive their behavior when using the computer and the Internet.

In both analyses, gender was the best predictor for how students may perceive deviance scores; hours spent on the computer is the next best predictor for both scores. The more time students spend online is likely to influence how deviance is perceived. Spending more time on computers and the Internet may lead students to perceive that their deviant behaviors are not deviant, especially if the students are committing deviance and nothing is happening. There may be no one to supervise students' online behavior. Consequently, students feel the behavior is not deviant.

Conclusion

The primary purpose of this study was to explore what middle and high school students perceive as deviant behavior when using the computer and the Internet. Based on the findings, it can be concluded that students do not perceive most of their behaviors on the Internet and computers as deviant. More specifically, the Peers' Behavior Score mean is higher than the Students' Behavior Score. Therefore, students do not perceive their behaviors as being as deviant as their peers. This attitude can be correlated to a theory known as the third person effect (Perloff, 1989). Cohen, Mutz, Price, and Gunther, (1988) defined the third person effect as how people represent themselves in relation to others. The students' image of themselves is more ethical than the students' image of their friends. Hence, their classmates are the ones that visit the pornography websites, access other people's websites without permission and perform other deviant acts when using the Internet and computers.

Additionally, this study will add to the small, but growing body of knowledge concerning students' perceptions of deviance when using the Internet and computers. We have gained an image of how students use the Internet and computers; how students spend some of their time online and how much time they spend using computers and the Internet. From this information, the following profile is generated of the possible characteristics of a student that may engage in computer or Internet deviance:

Male, possibly Asian, Hispanic or Other; ages 14-16;

Poor to fair academic achievement;

No religious affiliation;

No interaction with classmates or teachers;

From 5 to 9 hours a day spent on the Internet and/or computer;

May or may not have a computer at home.

When analyzing the above profile, keep in mind what Bologna (1981) perceived. He indicated that younger computer abusers find it to be challenging to beat the system, establishment or institution. The motive is not always to harm others or for financial gain.

To conclude, the researcher recommends the following to avoid or decrease the chances of deviance when using computers and the Internet at school and home:

- Decrease the size of computer classes to 18-22. One teacher can better manage this number.
- Teachers and parents should encourage students to talk about what they are doing on the computer and the Internet.
- Find out whom they are talking to in chatrooms and via instant messaging, as well as the types of websites they are visiting.
- Supervise their online activity. Students should not be alone for lengthy periods of time. When supervision is not possible, use software or hardware that will help to limit online activity.
- Schools that offer computer classes and access to the Internet should include information on appropriate computer and Internet behavior and ethics in their curriculum. Awareness is the first step to prevention and reducing the potential of abuse.

With the integration of computers and the Internet into the curriculum, there must also be responsibility. If deviance is to be avoided or decreased, all participants must take responsibility, which includes users and the suppliers. Educators and parents must be vigilant in their effort to discourage computer and Internet deviance.

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A Historical Chronology of the Plight of African Americans Gaining Recognition in Engineering and Technology

Keith V. Johnson and Elwood D. Watson

Africans and African Americans have contributed significantly to the evolution of many of the engineering technologies that we can identify with today in areas such as manufacturing, construction, electronics, design graphics, transportation. Due to past history, many African Americans' inventions have been obscured from the public eye. Further, the inventions of African slaves in America automatically belonged to their owners. It wasn't until after slavery that African Americans were given credit for their inventions when they were patented. But even when some patents were sold to Whites, African Americans did not receive proper credit. Therefore, it is virtually impossible to show all of the significant contributions of African Americans in our society.

Science is a pervasive and dominating force in American society. It is a primary source of the understanding of the worlds—physical, biological, behavioral, and social—in which we live; directly or indirectly, it shapes the boundaries and directions of all phases of American life. As a major institutional component of our society, the scientific community inevitably reflects the values of American society at large in its own social structures, beliefs, and attitudes. And, like American society in general, American science reflects the dominance of Whites (Bechtel, 1989). The Black scientist in America is historically an anomaly and currently a statistical rarity. In 1984 Blacks accounted for only 2.3%, or 90,500, of the 3,995,000 employed scientists and engineers (Kusmer, 1991) Even now, in the 21st century, Blacks were 11.3% of the labor force, but only 4.2% of natural scientists, 7.6% of math and computer scientists, and 4.6% of engineers.

In very simple terms, the source of the problem is obvious: There are few Black scientists because there are few Blacks in graduate science programs; there are few Blacks in graduate programs because there are few Blacks who are encouraged to take the undergraduate sources required for successful scientific careers; there are few Black undergraduates who are prepared by their high schools or grade schools to choose such courses. And at every point along the pipeline to a scientific career, large numbers of the young Black men and women who could be scientists turn away. Where does this happen? Why does it happen? And what can be done about it? (Bechtel, 1989).

The shortage of Blacks among the ranks of scientists, engineers, and mathematicians is not the result of some recent misdirected social policy. Rather, it is one dimension of the larger story of Blacks in American society and needs to be understood by reviewing past ideologies, practices, policies, and expectations of Whites and Blacks (Bechtel, 1989). It is necessary to examine the sociohistorical links among attitudes about race, educational policies, and the social structure of science. All three have worked to prevent Blacks from entering science or from having their scientific contributions acknowledged and rewarded.

This article focuses on the contributions of African Americans to scientific and technological innovations. It was written not to disprove or discredit nonminorities who were given full credit for an invention or contribution to technological society but to recognize the contributions of Africans and African Americans who significantly helped mold and direct the evolution of technology. This article is also intended for technology education teachers to use as a tool to encourage African American youth to realize that they have a very brilliant heritage and wealthy history. This paper attempts to reveal a legacy of intelligence, and it serves to inspire future African Americans to keep the torch of technological innovation and invention aflame.

During the first half century of the nation's history, in New England and the mid-Atlantic states specifically, revolutionary spirit, growing abolitionist sentiment, and Christian missionary fervor favored the education of Blacks. The work of various religious groups, most notably the Quakers, to establish schools for Blacks is well documented. The efforts to provide instruction to Blacks during this period were generally local and unconnected, reflecting the interests of the diverse groups involved. Thus, some

communities provided integrated public instruction while others had separate facilities. The growing intensity of antislavery sentiments in parts of the North prompted some communities to adopt policies that would allow more Blacks to attend public schools (Franklin, 1973; Frazier, 1949; Woodson, 1915).

The results of this movement were impressive as free Blacks took advantage of opportunities to get an education. Of the 2,000 Blacks in Boston in 1850, almost 1,500 were in school; and in the states and territories as a whole, 32,629 Blacks were in school in 1860. Blacks also began to move into higher education. In 1826 Edward Jones graduated from Amherst while John Russwurm was getting his degree from Bowdoin -the first Black to graduate from college in America. Blacks were attending Oberlin and other institutions of higher education well before the Civil War (Franklin, 1973; Pifer, 1973).

Although most of these educational efforts were provided and controlled by Whites, Blacks also played a role. A few schools were established by Blacks, and in such large cities as Philadelphia Blacks began to organize literary societies as early as the 1780s (Funke, 1920; Winston, 1971).

The social climate in the South during the slavery era effectively precluded educating Blacks. Interest in public education in general was low. Whites who wanted schooling were expected to rely on their families for financial support. There were a few isolated efforts to provide free Blacks with an education, and some progressive plantation owners felt morally bound to teach their slaves to read and write. Any possibility of these practices gaining widespread support quickly vanished with the abortive revolts by Prosser (1800) and Vesey (1822), and the Turner rebellion (1831). These actions by Blacks who had been educated so frightened the planters that laws were passed throughout the South making it illegal to instruct any slave or free Black (Franklin, 1973; Funke, 1920; Low & Cliff, 1981).

During the decade of Reconstruction following the Civil War, Blacks made temporary gains in their social and political conditions. Passage of the Thirteenth, Fourteenth, and Fifteenth Amendments to the Constitution and the Civil Rights Act of 1866 gave Blacks freedom and rights of citizenship and hindered restrictive legislation that attempted to reestablish antebellum social relationships (Bond, 1934; Brawley, 1970). Probably the most significant change came in the area of education. The emancipated slaves were eager to take advantage of their new status and felt that getting an education was of primary importance. And many individuals and organizations interested in aiding the freedmen were quick to offer their services (Woodson, 1969).

Even before the war ended, missionaries began to make their way into the Southern states to establish educational programs for those Blacks freed by the advancing Union troops. Immediately after the war, religious organizations, such as the American Missionary Association and the government-sponsored Freedmen's Bureau, established schools in the South. Blacks responded eagerly, and thousands were attending schools by the late 1860s (Bond, 1934; Cruden, 1969; Funke, 1920).

White Southerners, however, were unprepared for such a radical change and opposed efforts to provide education for Blacks, who were considered innately inferior—the idea of educating them was viewed as absurd. Providing educational opportunities to Blacks would have meant extending a privilege that had historically been restricted to the upper classes in the South; it would elevate the former slave to a status higher than that of most former slave owners. Conservative Southerners feared that the schools taught by Northerners would instill Republican ideals of equality and further undermine their political power. The hostile reaction by Southerners to Black education was a predictable part of their attempt to maintain the traditional antebellum social order in the face of massive social dislocation (Bechtel, 1989).

Nevertheless, some Southern Whites grasped an obvious fact: The Freedmen would have to be educated simply to survive and provide for their own basic needs. At the end of the Civil War, 95% of the Black population in America was illiterate. To most enlightened observers, the presence of this large number of "ignorant Black rabble was a menacing Trojan horse" (Winston, 1971, p. 681). White Southerners faced a serious dilemma that went beyond simple questions of educational philosophy. The way this problem was addressed would have a significant impact on important issues of

political and economic relationships because once Whites chose to educate Blacks, they had to decide what type of education should be provided. And that decision ultimately depended upon the role that Whites saw for Blacks in the American social order.

From an egalitarian perspective, education is a means of raising those less fortunate up to a level on par with the rest of society. If such a goal had been paramount at the end of the Civil War, what sort of educational program could have been developed? Ballard (1973) described a possible scenario.

> First, there would have to be federally funded elementary schools in every village. Second, a federally funded group of highly trained teachers would have been sent to those villages. Centers of literacy would have to be established for adult education. This first thrust could have carried through for five to ten years, to be followed by the establishment of regional high schools with both vocational and academic curricula to serve as the funnel through which the most able Black youth would have gone on to federally subsidized colleges. Over a period of fifty or seventy-five years the educational level of the Africans would have risen to that of White Americans. (p. 11)

Ballard makes clear that it was unthinkable that Whites during Reconstruction would have allowed anything of the sort. If Blacks had to be educated, White Southerners felt that the education should be suited to their inferior mental capacities and to their proper, subservient place in society. With the goal decided upon, the two pillars of post-Reconstruction Black educational philosophy emerged: a system of separate and unequal schools for Blacks and industrial education.

During Reconstruction, the quality of education provided in the South had been generally poor for both Blacks and Whites, but it was administered on a fairly equal basis. After the end of Reconstruction and the reemergence of Southern conservatives in political power, the policies of Black social and political disenfranchisement extended to Black education as well. Through deception, blatant discrimination, and law, White schools were improved at the expense of Black schools. An examination of the data on school expenditures from the mid 1870s to 1930 clearly reveals the massive disparities between the education of Whites and Blacks in the South.

Data (Bond, 1934) for the state of Alabama indicate the changes that took place over the 55-year period from 1875 to 1930. During the 1875-1876 school term, Alabama spent an average of $1.30 per pupil for White teachers' salaries and $1.46 per pupil for Black teachers' salaries. This difference in favor of Black teachers reflects the impact of the Reconstruction administration. By 1885, however, Alabama was paying Black teachers 85% of what was paid to White teachers ($1.09 versus $1.28). And 25 years later, Black Alabama teachers still received only $1.10 per pupil whereas their White counterparts got nearly six times as much ($6.42).

Although the figures from Alabama show the dramatic decline over time in expenditures to Black teachers, the data from Tennessee reveal no change whatsoever over the 60-year period from 1870 to 1930. In 1870 Tennessee paid its White teachers $11.83 per pupil compared to $7.48 for Black teachers—63% of the White teachers' salary. By 1931 Tennessee was paying its White teachers $27.55 per pupil compared to $17.25 for Black teachers—again only 63% of the White teachers' salary (Bond, 1934).

Harlan (1968) noted that the regional differences in funding for White schools paled when compared to the economic disadvantages suffered by Black schools. In 1915 the North Central states spent an average of $28.00 per White child for education compared to only $14.00 per White child in South Carolina. But at the same time, South Carolina was spending only $1.13 per Black child for education.

Statistics revealed the degree of inferiority of funding of Black education compared to that of Whites in the South. Using Washington, DC, as a point of comparison, one finds that spending by the six Southern states on school expenses, school property, and teacher salaries falls far short of anything that could be remotely called "equal" education. The breadth of the discrimination against Black education is revealed in other areas as well. For example, during the 1933-1934 school year, 10 Southern states spent a total of $20 million on transporting rural school children. But, only 3% of this money was spent on Black children who constituted

34% of the total school population. In 1935-1936 over half (55%) of the 24,405 Black public elementary schools in the 18 states with separate schools were one-room schools. In terms of total property value, in 10 Southern states for which data were available, for every $1.00 invested in school property for each White student, only $0.19 was invested for each Black student (Frazier, 1949).

Factors other than direct discrimination in finances also undermined the ability of Blacks to acquire an adequate education. Black attendance remained relatively low because Black schools were often distant and so little transportation was provided. But because the number of Black teachers was also small, the typical teacher in a Black school would, on the average, have twice as many students as the typical teacher in a White school. Possibly most damaging was the practice of having shorter terms for the Black schools. In the 1929-1930 school year, for example, the average length of the term for the 18 Southern and border states, including Washington, was 164 days for Whites and 144 days for Blacks. However, in South Carolina the average school term was 173 days for Whites compared to only 114 days for Blacks (Work, 1931). After eight years of school, the typical Black student in South Carolina would have been in class 472 days less than the typical White student—in other words, he or she would be approximately four years behind. This policy, combined with the fact that few secondary schools were established for Blacks, goes far toward explaining why few Blacks during this period attained more than a sixth-grade education (Rice, 1971).

Much of this discussion of Black education has focused on the Southern states. One must not conclude that the educational experiences of Blacks in the North were any better. During the 18th and 19th centuries, Blacks were few in number in the North and West and did not arouse the fear and apprehension found in the South. Life was therefore different for those Blacks who lived in the various Northern states. They were not subject to the whims of a master, the restrictions on their activities were less severe, they could protest against injustices, and there were more opportunities for self-expression (such as churches and newspapers) and improvement in one's political and economic position (Litwack, 1961; Quarles, 1969).

Popular beliefs and attitudes about Blacks were not restricted to a particular region of the country, and the belief in Black inferiority was shared by most White Americans. Discrimination and racial segregation were facts of life for Blacks in both the North and South. And the justification for such practices was the same everywhere: Blacks constituted an inferior race suited only for the most menial of positions (Litwack, 1961).

Despite having comparatively greater freedom in the North, Blacks found that there was strong opposition to their receiving an education. Many Northern states were unwilling to spend money on schools for Blacks, fearing that more of them would move into their states or communities seeking education. Northerners seemed no more fond of Blacks than Southerners. Ohio, Illinois, and Oregon had laws forbidding the migration of free Blacks into their states. Although Northern states did not pass laws prohibiting the teaching of Blacks, there was an undercurrent of resentment toward educating Blacks that found expression in the forcible closing of schools, the intimidation and driving away of teachers, and the destruction of school buildings (Beale, 1975; Bond, 1934).

While some White schools in the North admitted Blacks, this occurred mostly during the early 1800s. By 1830 most Northern states had excluded Blacks from White schools and required them to attend separate all-Black schools. Reflecting the prevailing belief in the limited intellectual capability of Blacks, these separate schools were often as unequal as those in the South, with substandard teachers, inadequate facilities, and inferior curricula (Litwack, 1961).

Frazier (1949) remarked that the problems facing Blacks in the public schools of the North were similar to those faced by the large number of immigrants who settled in the major urban centers. As with the immigrants, Blacks had been forced to live in the poorest sections of the cities and their children had to attend old, inferior, and overcrowded schools. Nevertheless, Blacks suffered additional problems: Because of their color, they were restricted in their movement both socially and economically. Greer (1973) noted that with varying degrees of speed, foreign immigrants were able to become part of American society, whereas Blacks remained on the margin. Both groups were vulnerable

because of their low social status, but it was the individual immigrant who suffered the consequences of economic change, whereas for Blacks the entire group was affected. Thus, caste through race added a significant dimension to the life of the lower class Black in the urban North.

Despite widespread animosity toward Blacks, they did receive more education in the North, although the quality of that education was inferior. Frazier (1949) reported figures for 1940 that show the proportion of Blacks with four years of high school in the South was only 25% of the total, whereas in the North it ranged from 50% to 75% of the total. The reality, however, is that North or South, Blacks in America received an inadequate and inferior education when compared to that available for more Whites.

The content of Black schooling adequately reflected White goals for Blacks in the social order. Industrial training was an effective way of ensuring that Blacks could not rise beyond what was seen as their natural sphere as laborers and servants.

Industrial education had its beginnings at Hampton Institute under the direction of General Samuel Armstrong, a Freedmen's Bureau administrator in Hampton, Virginia. A believer in the innate inferiority of Blacks, Armstrong thought that the best training for Blacks was one that would instill self-control and provide a check on what he believed was the natural tendency of Blacks toward rebellion. His program of education was intended to affect a change in the freedman's innately flawed character, to "civilize" the Black by instilling "habits of living and labor" (Spivey, 1978, p. 19). Armstrong believed that Blacks were ultimately destined to "form the working classes" and remain at the bottom of the economic hierarchy (Spivey, 1978). Having no faith in Blacks' intellectual capacity, Armstrong thought it was a waste of time to give them academic training, stating that courses involving "reading and elocution, geography and mathematics, history, the sciences . . . would, I think, make a curriculum that would exhaust the best powers of . . . those who would for years enter Hampton" (Spivey, 1978, p. 26). Thus, education at Hampton under Armstrong was designed to maintain the Southern status quo. Black students would be trained in the principles of agriculture, unskilled menial labor, and domestic service—activities that would not be a threat to White skilled workers and would keep Blacks in their proper place in the social and economic structure (Spivey, 1978). But while Armstrong was the originator of vocational education, it took a Black man to make industrial training a prominent feature of Black education.

The few Blacks who managed to overcome educational obstacles and enter careers in science and technology still faced bigotry in other aspects of their lives. This discrimination extended to the lack of public recognition of names and accomplishments of Black scientists, medical researchers, and inventors. Only recently have scholars begun to search out evidence of these Blacks' contributions and discover that, although Blacks are rare in the history of American science, they are by no means missing or negligible. It is worth noting that, for many of the same kinds of reasons, the presence and activities of women in science were long overlooked by historians and only recently have been reexamined (Rossiter, 1974).

It is appropriate to describe briefly the work of some of these Black American scientists and inventors and to examine the ways in which they surmounted the formidable barriers to intellectual achievement.

Before the Civil War, the United States was not known for its scientific accomplishments. It would not make sense to expect Blacks to be the exception to this rule. For most slaves and free Blacks, the main issue was gaining and keeping their freedom. Many Blacks with exceptional abilities directed their talents to devising ways to gain their own freedom and to interest others in supporting such efforts. Inevitably, preachers and orators outnumbered inventors among the Black community during the antebellum period (Baker, 1913/1969).

It is also true that Black inventors, especially in the South, were unrecognized by historians. Slaves who invented mechanical devices to relieve the physical burden of labor could not protect their rights to the inventions (Baker, 1913/1969). They were not recognized as citizens and therefore could not enter into contracts. The federal government refused to grant them patents or to allow them to transfer patent rights to their owners. This did not preclude the outright theft of inventions by the slave owners,

who would claim them as their own. Given this situation, it can never be known how many inventions were originated by slaves (Haber, 1970). Among free Blacks, inventors preferred to have their race kept secret for fear that such information would impair the commercial success of their devices (Baker, 1913/1969).

Government restrictions on the granting of patents to slaves did not apply to free Blacks. For example, James Forten (1766-1842), a free Black Philadelphian, had no difficulty in getting a patent for his invention for handling sails or deriving a comfortable living from its manufacture. The same could be said of Norbert Rillieux. Born in New Orleans on March 17, 1806, Rillieux was the son of Vincent Rillieux, a wealthy plantation owner, and his slave Constance Vivant. Because of his father's position, the young Rillieux had the advantages of both freedom and wealth. He attended Catholic schools in New Orleans and studied engineering in France. At the age of 24, he became the youngest instructor in applied mechanics at L'Ecole Centrale in Paris and contributed papers on steam technology to engineering journals (Klein, 1971). His major accomplishment came in 1846 when he invented and patented a vacuum pan that transformed the process of refining sugar. The device yielded a superior product—granulated sugar—at a low price. The invention was a boon to the sugar industry in Louisiana and revolutionized the production of sugar worldwide (Baker, 1913/1969; Haber, 1970; Ploski & Williams, 1983; Toppin, 1971).

A discussion of early Black inventors cannot fail to mention the accomplishments of Benjamin Banneker. The son of a free Black mother and a slave she had purchased, Banneker was born in Baltimore County, Maryland, in 1731. Taught to read and write at home by his grandmother, Banneker also attended an integrated public school where he obtained the equivalent of an eighth grade education. In 1761, his curiosity about mechanical devices led him to construct a wooden striking clock so accurately made that it kept perfect time for over 20 years. His knowledge of astronomy and his mathematical ability enabled him to predict the solar eclipse of 1789. During the next 10 years he published an almanac of tables, eclipses, and medicinal formulas. His most notable contribution came as a surveyor with the team chosen by George Washington to develop the plans for the new national capital. Although publicly recognized in France and England for his scientific accomplishments, he received little official recognition in the United States—although in 1970, Banneker Circle in Washington, DC, was named in his honor (Haber, 1970; Ploski & Williams, 1983; Toppin, 1971).

During the second half of the 19th century, a number of Black inventors produced devices of considerable importance in the mechanical advance of American industry. Most noteworthy were Lewis Latimer, Granville T. Woods, Elijah McCoy, and Jan Earnst Matzeliger.

Jan Matzeliger was born in Dutch Guiana in 1852. He immigrated to Philadelphia at the age of 10 and went to work in a shoe factory. He realized that while the tops and bottoms of shoes were being manufactured by machines, the two parts had to be put together by hand—a time-consuming bottleneck in the production process. He spent long hours at great physical and financial cost to do the seemingly impossible—invent a machine that would sew the top and bottom halves of manufactured shoes together. After Matzeliger developed his lasting machine, it was possible for one factory to produce 150 to 700 pairs of shoes a day, compared to 50 pairs sewn by hand. The cost of shoes went down, and the American shoe industry grew dramatically. Matzeliger died in 1889 at the age of 37 and never realized any of the millions of dollars that eventually derived from his invention (Haber, 1970; Logan & Winston, 1982; Ploski & Williams, 1983).

Elijah McCoy was born in Canada in 1844 to runaway slaves. He attended grammar schools in Michigan and went to Scotland to apprentice as a mechanical engineer. Upon returning to America, McCoy found that because of his race it was impossible for him to find employment as an engineer. He eventually took a job as a fireman on the Michigan Central Railroad where his experiences with maintaining the locomotive engines inspired him to invent a device that solved a critical problem in the manufacturing industry. Heavy machinery constantly needed lubrication to prevent the metal parts from fusing together. In the late 19th century, factory workers had to stop the machines and lubricate the parts by hand, a time-consuming and costly procedure. McCoy invented the "lubricating cup," which provided continuous and automatic lubrication of moving

parts. His inventions were significant in perfecting the overall lubrication system eventually used in all large industrial plants with heavy machinery. Over a period of 40 years, McCoy acquired more than 50 patents for his lubrication devices, yet he died poor, as his race made it difficult for him to realize any profit from the inventions that made millions for others. Although not documented, it is often claimed that the expression "It's the real McCoy" is associated with his devices (Haber, 1970; Ploski & Williams, 1983).

In the area of electrical engineering, Granville T. Woods and Lewis Latimer deserve special recognition. Born in Ohio in 1856, Granville T. Woods attended school until the age of 10. First employed in a machine shop, he continued to develop his mechanical aptitude working on the railroad and reading books on electricity in his spare time. He reportedly took a course in electrical and mechanical engineering but was essentially self-taught. He invented a telephone transmitter in 1884 but is best known for his development of the Synchronous Multiplex Railway Telegraph. This system enabled communication between stations and moving trains and greatly improved railway safety. In the 20-year period from 1879 to 1899, 23 separate inventions bore his name, including the overhead conduction system for electric railways and the "third rail" used in most subway systems. Known as the "Black Edison," he held over 60 patents, many of which were assigned to General Electric, Westinghouse, and Bell Telephone (Haber, 1970; Logan & Winston, 1982; Ploski & Williams, 1983; Toppin, 1971).

Lewis Howard Latimer was born in Massachusetts in 1848. At the age of 10, Latimer was forced to quit school and help support his family. After serving in the United States Naval Service during the Civil War, he was employed as an office boy with Crosby & Gould, Patent Solicitors. Demonstrating his superior skill after reluctantly being given the chance to try his hand at drafting, Latimer ultimately was named chief draftsman. Needing a skilled draftsman to help prepare his patent application, Alexander Graham Bell asked Latimer to prepare the drawings and descriptions for the telephone patent issued in 1876. Latimer eventually began to work on his own inventions, and in 1881, he developed a method of making carbon filaments that were longer lasting than previous filaments, greatly improving Edison's incandescent lamps. He supervised the installation of electric lights in New York, Philadelphia, Montreal, and London. In 1884, Latimer joined the Edison Company, where he was instrumental in defending Edison's patents in court (Haber, 1970; Logan & Winston, 1982; Ploski & Williams, 1983).

Most of the Black scientists and inventors of the 19th century were very gifted, self-taught individuals who lacked academic or professional training in the physical sciences. This should not be surprising since the description would apply equally to White American scientists and inventors at the same time. In fact, it was only in 1861 that the first doctorate was granted in a science—physics—at Yale University. Probably the most noteworthy accomplishment in the history of Blacks in science occurred just 15 years later. In 1876, Edward Alexander Bouchet, a 24-year-old Black man was awarded a PhD in physics from Yale University for a dissertation in geometrical optics entitled *On Measuring Refracting Indices*. Bouchet was the first Black to receive a doctorate from an American university and only the sixth person in the United States to be awarded a PhD in physics. Yet, other than an occasional footnote in the history of Black education, Bouchet and his accomplishments remain virtually unknown to the world of science and literally unheard of by the world in general. What happened to Bouchet provides a glimpse into the adversity facing educated Blacks in post-Civil War America.

Edward Bouchet was born in 1852 to free parents in New Haven, Connecticut, where he attended a public "colored school." Like most of the schools for Blacks in the city, it was small, ungraded, and had only one teacher. In 1868, Bouchet was the first Black to be accepted into Hopkins Grammar School, a preparatory school for the classical and scientific departments at Yale College. During his two years at Hopkins, he studied Latin and Greek grammar, geometry, algebra, and Greek history. He graduated first in his class in 1870 and was chosen valedictorian (Bechtel, 1989).

Bouchet entered Yale University in the fall of 1870 and continued to excel. When he graduated in 1874, his grade-point average was 3.22 on a 4.0-point scale, the sixth highest in a class of 124. In 1875, Bouchet returned to Yale to pursue graduate work in physics. During his two years in the graduate school, he paid special

attention to chemistry, mineralogy, and experimental physics. Under the direction of Arthur Wright, he successfully completed his dissertation (Bechtel, 1989).

Bouchet's graduate education was encouraged and financed by Alfred Cope, a member of the board of managers of a Friends school for Blacks in Philadelphia, the Institute for Colored Youth (ICY). Firm believers in the value of liberal education and the unlimited capabilities of Blacks, Cope and the other managers offered at ICY a curriculum that included ancient history, geography, Greek and Latin classics, algebra, geometry, and chemistry. In an effort to expand the school's offerings, Cope established a Scientific Fund to promote learning in the principles of applied science. It was the establishment of the Scientific Fund that led Cope to invite Bouchet to head the new science program (Perkins, 1978).

Bouchet arrived in Philadelphia in the fall of 1876 and taught at the ICY for the next 26 years. However, as with all American Blacks during the last two decades of the 19th century, Bouchet's life took a turn for the worse. By the mid-1890s, many Philadelphia Quakers were becoming disillusioned with the Black community as they now questioned the ability of Blacks to respond to the efforts being made on their behalf. In 1894, a study made of the institute's curriculum suggested that it be simplified, stating that the courses were "pitched too high." By the end of the century, the new managers had become openly hostile to classical and academic education and receptive to Booker T. Washington's educational philosophy. In their efforts to redirect the ICY along the line of industrial training at Hampton and Tuskegee, the managers proceeded to fire all the teachers, including Bouchet, and replaced them with instructors favorable to industrial education (Bechtel, 1989; Perkins, 1978).

No White college would have considered him seriously for a position on its faculty even with his superior qualifications. But barriers other than race had an impact on Bouchet's career. The ascendance of vocational-industrial instruction during the latter half of the 19th century, and the overwhelming acceptance of the Hampton-Tuskegee model for Blacks in particular, served to limit Bouchet's opportunities. His academic education and his training in the natural sciences made him increasingly unattractive as a candidate at Black colleges that had adopted the industrial-education philosophy. As noted by DuBois (1973), the debate between academic and industrial education was a bitter one. "The disputants came to rival organizations, to severe social pressure, to anger and even to blows. . . . Employment and promotion depended often on a Negro's attitude toward industrial education. . . . Men were labeled and earmarked by the allegiance to one school of thought or to the other" (p. 65).

The difficulties that the industrial-education movement created for Bouchet were tragic not only for him but also for the future generations of students he might have trained in science. The movement stopped students from striving for professional careers, it perpetuated stereotypes about Black intellectual inferiority, and it kept Blacks in economically inferior jobs. Even on its own terms, it misjudged the demand for Blacks in the trades, arousing the hostility of White workers. It failed to see that the rise of large corporations would put many tradesmen and craftsmen out of business (DuBois, 1973; Franklin, 1973).

Although Whites enthusiastically endorsed industrial training for Blacks and helped to implement it through contributions to Black schools, it is noteworthy that some Blacks resisted. W. E. B. DuBois led this movement against industrial education, while leaders at some Black colleges refused to change their curriculum in the direction of Tuskegee and Hampton. An important change occurred at the beginning of the 20th century as a small number of men and women began to move into the fields of science and engineering. Consider, for example, three Blacks who made scientific contributions to biology and medicine: E. E. Just, Percy Julian, and Charles Drew (Bechtel, 1989).

Born in Charleston, South Carolina, in 1883, Ernest Just received his bachelor's degree with honors from Dartmouth. In college he developed an interest in biology, especially cell structure and development. After graduating from Dartmouth, he taught biology at Howard University and began a 20-year period of summer research at the Marine Biological Laboratories at Woods Hole, Massachusetts. In 1916, he received his PhD in biology from the University of Chicago. During his career, he published two books and over 60 papers in scholarly journals. His ideas on cell-membrane

activity completely changed the scientific opinion of his time as he successfully demonstrated that the cells' cytoplasm and ectoplasm are equally important as the nucleus in heredity. As with most of the Black scientists of the period, Just never received proper recognition in the United States, although he was respected and honored in the scientific capitals of Europe (Haber, 1970; Manning, 1983; Ploski & Williams, 1983; Toppin, 1971).

Born in Alabama in 1899, Percy Julian attended DePauw University, where he was valedictorian and Phi Beta Kappa. He taught at Fisk, Howard, and West Virginia State College before attending Harvard and the University of Vienna. A specialist in derivative and synthetic drugs, Julian discovered cortisone, a cheap and effective treatment for arthritis derived from soybean oil. In 1935, Julian was the first to synthesize physostigmine, important in the treatment of glaucoma. He was also the first to synthesize hormones, greatly reducing the cost of these drugs and making them available to thousands of people who were unable to afford the expensive natural drugs. He was offered the post of chief chemist and director of research for the Glidden Company in Chicago, the first Black scientist to obtain such a prestigious position. This was a turning point in the struggle of Black scientists to gain access to America's research facilities (Haber, 1970; Ploski & Williams, 1983; Toppin, 1971).

Charles Drew, medical doctor and researcher, was educated at Amherst College in Massachusetts and took his medical degree from McGill University in Canada. Early in his career, he became interested in the problems associated with the transfusion and storage of blood. He took a teaching position at Howard University and while working on his doctor of science degree at Columbia wrote a dissertation on banked blood. He soon became an expert on separating and storing blood, and his research on blood plasma is credited with saving many lives during World War II. In 1941, he was called to England to help with the problems of blood storage and set up the first blood bank in England. Drew was one of the first Blacks to become a diplomat in surgery and the first Black to be appointed an examiner by the American Board of Surgery (Haber, 1970; Ploski & Williams, 1983; Toppin, 1971).

To this discussion of unrecognized scientists must be added several others. One is Charles H. Turner, who received his doctorate from the University of Chicago in 1907. He published many papers in the area of animal behavior, and the phenomenon of insect activity referred to as "Turner's circling" is named for him. William A. Hinton was an authority on venereal disease and responsible for developing the Hinton Test for detecting syphilis. In 1949, he became the first Black professor of medicine at Harvard. Lloyd A. Hall was chief chemist and director of research for Griffith Laboratories in Chicago. He transformed the meatpacking industry with his development of curing salts for processing and preserving meats. Louis Tompkins Wright was a leading surgeon and medical researcher best known for his work in developing the intradermal method of smallpox vaccination. He also pioneered in drug therapy for cancer and was the first to use chlortetracycline on humans. A graduate of Harvard Medical School, Wright was the first Black to be elected to a fellowship in the American College of Surgeons (Haber, 1970; Logan & Winston, 1982; Ploski & Williams, 1983).

There is little doubt that White scientists of this caliber won recognition from the scientific world in the form of research grants, prestigious positions, and prizes. More important, they were urged to continue their research and their teaching of future scientists. In light of the racism and discrimination these Black scientists faced, their accomplishments are even more impressive, yet their names and deeds remain obscure. Students quickly learn the importance of such men as Benjamin Franklin, Eli Whitney, Thomas Edison, Alexander Graham Bell, and Jonas Salk. These individuals are held up as great scientists and inventors whose work was instrumental in the transformation of American society. Students rarely learn the names Benjamin Banneker, Norbert Rillieux, Granville T. Woods, Lewis Latimer, or Percy Julian, or their equally important contributions to the transformation of American science and industry.

The achievements of Black intellectuals and scientists in White America have been largely obscured, ignored, or diminished in importance. The world of science and research was the private domain of White males. Society provided Blacks with more appropriate arenas for gaining

success and notoriety, arenas more fitting for their place in the American social order. The roles of gladiator and jester have long been traditional among powerless people and are often seen by the dominant group as more appropriate than that of scholar or scientist (Lewis, 1972). According to the stereotype, Blacks were to perform, produce, or entertain, not invent, design, or create. The former activities require only simple innate abilities; the latter intelligence and creativity—characteristics not thought to be present in Blacks.

From the perspective of White America at the turn of the century, educated and intellectual Blacks presented a grave problem. They were not supposed to exist, and the fact that they did exist challenged the very foundation of the White belief in Black intellectual and social inferiority (Winston, 1971). Therefore, such individuals had to be explained away (they were called freaks), minimized (they were accused of stealing their ideas from Whites), hidden (they were not acknowledged), or destroyed (they suffered discrimination and violence). The lives of early Black scientists were filled not only with the challenge and elation of scientific discovery, but with the specter of racism and discrimination as well.

During his brief tenure at St. Paul's College in Lawrenceville, Virginia, Edward Bouchet was respected and admired in the community. Nevertheless, he was assaulted by a White lawyer he accidently bumped into as they came around a corner (Bechtel, 1989). Percy Julian was denied appointment as head of DePauw's chemistry department because he was Black, and he would not go to Appleton, Wisconsin, for a job interview because of a city statute prohibiting Blacks from staying overnight. During his tenure at Glidden, his house in Oakbrook was set afire and bombed in several acts of racial violence. Ernest Just, despite his scientific discoveries, was never offered an appointment at a major American research center or university and was urged by Whites to teach at Black universities in order to help his race (Haber, 1970; Logan & Winston, 1982; Manning, 1983).

More important than these acts of racism toward individuals are the patterns of institutional discrimination that created an almost insurmountable obstacle to the Black scientist. Segregation produced isolation: Black PhDs in science were forced to teach in Black colleges and high schools, which were often unsympathetic to the needs of a research scientist. Edward Bouchet and Charles Turner spent most of their careers in high schools with limited resources and poorly equipped labs. Those who were fortunate enough to find positions in Black colleges (like Just or Julian) often taught students from the inner city or rural areas, who lacked advanced training in mathematics and English. These teachers seldom had the scientist's pleasure of training students to surpass their mentors. Black colleges had little money available for scientific equipment or libraries. In the South, where most Black colleges were located, Black scholars were denied use of public libraries and White university laboratories and were barred from local chapters of learned societies (Julian, 1969; Winston, 1971).

To this can be added Jim Crow laws designed to restrict the social and political actions of Blacks, the constant threat of violence reinforced by numerous lynchings every year, and the exclusion from the community of science in general. In this type of restricted and fearful environment, the PhD degree was a farce (Julian, 1969). Excluded because of their race from full participation in the American scientific community, these scientists languished in obscurity.

Under such historical conditions, it is no wonder that so few Blacks chose to study science. Ernest Just's motive in discouraging his students from pursuing careers in science grew out of his own bitter recognition of the reality they faced (Manning, 1983; Winston, 1971). For Blacks at the turn of the century, education had to provide marketable skills, a point of view that continues to direct scientifically talented students into careers in education, medicine, or law rather than biology, physics, or chemistry. For any Black who knew about Just, Julian, or Turner, the lesson was clear: Even those with the highest level of education and degrees from America's most prestigious universities were denied the recognition and respect befitting their qualifications and scientific accomplishments. In the fields of medicine, teaching, and law, one could find jobs and prosper, albeit while restricted to serving a Black clientele. Under the rules made by Whites concerning the roles Blacks were to play in American society, the pragmatic Black decided it was better to be

an employed teacher or lawyer than an underemployed scientist.

Specific evidence supports this argument. Edwards (1959), in a survey of 300 Black professionals, found that half of the respondents had given serious consideration to careers other than the one they presently had. Many expressed a primary interest in becoming engineers, architects, or research scientists but felt that Blacks could not earn a decent living in these occupations. One of Edwards's respondents, a physicist now working as a teacher, had wanted to enter the field of engineering. He changed his mind when it became clear that despite his ranking near the top of the class, White classmates who were far below him could get jobs as student laboratory technicians while he could not.

The Black scientist is both rare and relatively unknown: rare because of an educational philosophy that produced laborers not scholars, and unknown because White society has often refused to recognize the contributions of those able to overcome the obstacles placed before them. In part, this failure to recognize the Black scientist stems from beliefs about Black inferiority. To acknowledge these individuals would be to demonstrate the fallacy of those beliefs and the effort of the policies that deprived Blacks of equal and quality education.

Separate, unequal, and discriminatory educational policies served to keep a generation of Blacks at the bottom socially, politically, and economically. And while a few (such as Bouchet, Just, and Julian) were able to break through and acquire a quality education, being Black meant that in most instances the rewards were withheld. The rare Black scientist was faced with a lack of research facilities, funds, and recognition for achievements that by any standard were of superior quality and importance. Given the historical conditions, one can understand why Black scientists were treated in such a manner. But to understand is not to justify. Educational policies served to suppress and demoralize generations of Blacks in America, creating discredible castes within an ostensibly open society.

History is more than description and explanation; one can often use the past to examine the present. What has the past taught with regard to current educational policies directed toward Blacks? Several major themes can be identified. First are *interest* and *motivation*. Historical evidence shows that Blacks in America had a strong interest in and motivation for getting an education. This desire continues as large numbers of Blacks seek higher education. Second is *opportunity*. The evidence is just as clear that Blacks were denied the opportunity for a quality education by legal and extralegal means. Today, Blacks are able to take advantage of educational opportunities as many of the barriers of the past have been removed. And third, is the *reward* or *payoff*. Given the historical conditions, for most Blacks there was no payoff for getting an education. Today, the picture appears more positive as Blacks are found in all professions and at all levels of achievement (Betchtel, 1989).

Yet, below the surface a different image can be seen. Less than 2% of all doctoral scientists in America are Black, and few Black students take courses in the sciences or express a desire to pursue such careers. For those who complete graduate school, the door to a science career is opened. The problem, as in the past, remains at the level of basic educational opportunity and experience. America has desegregated its White schools and has renounced its past practices as counterproductive and mean-spirited. But those practices remain, in effect, in the form of tracking, curriculum reform, and teacher expectations.

Eighty years ago, vocational education served to perpetuate Black social and economic inferiority, locking a generation of Blacks into low-paying, low-status jobs. Today, Black children are bused to excellent schools in an attempt to equalize educational opportunity. Yet once off the bus and in the school, they are tracked, counseled, or intimidated away from academic courses into less rigorous curricula. At the turn of the century, the typical student at Hampton or Tuskegee learned simple trades and domestic skills while American industry was going through a transformation that was making such skills obsolete. Today, the typical Black student studies a watered-down curriculum devoid of higher level math and science courses while we are living in a computer age that is transforming the world into a more complex and scientifically sophisticated arena (Bechtel, 1989).

To break the hold of the past, parents, educators, and policymakers need to move forward

and address the educational deficiencies that continue to derail the scientific careers of Black students in America.

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Articles

Undergraduate Engineering and Psychology Students' Use of a Course Management System: A Factorial Invariance Study of User Characteristics and Attitudes

Stephen A. Sivo and Cheng-Chang "Sam" Pan

Implementing information systems (IS) is expensive and sometimes unsuccessful due to low levels of system user acceptance (Legris, Ingham, & Collerette, 2003). For this reason, IS research has focused, in part, on variables contributing to system user acceptance of technology. As a part of this effort, Davis (1989) theorized and tested the technology acceptance model (TAM) to describe how system user characteristics influence patterns in technology use. Since then, the TAM has survived empirical scrutiny in varied contexts (e.g., Davis, 1993; Lee, 2002; Legris et al., 2003; Pan, 2003; Pan, Gunter, Sivo, & Cornell, in press; Pan, Sivo, & Brophy, 2003; Venkatech, 2000; Wiedenbeck & Davis, 1997). The viability of the TAM has encouraged a continued investigation of its applicability as well as revisions and extensions. Many modifications considered have in common a focus on client side variables exogenous to the original model (e.g., Anandarajan, Igbaria, & Anakwe, 2000; Legris et al., 2003; Venkatech, 2000; Wiedenbeck & Davis, 1997; Wolski & Jackson, 1999).

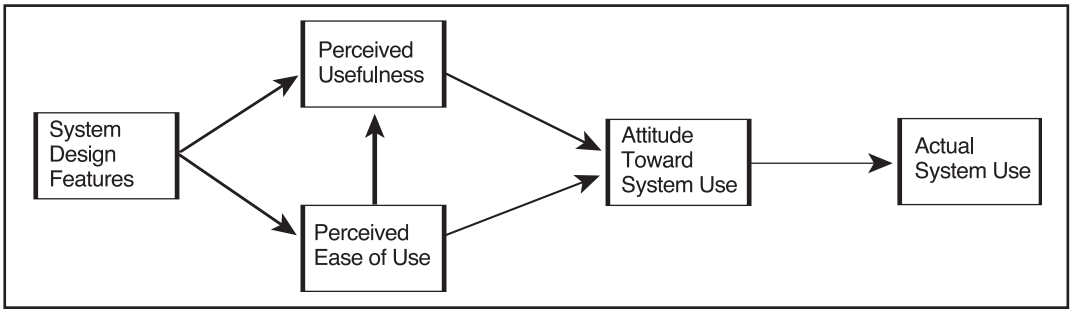
With respect to IS implementation in institutions of higher education, colleges and universities in the state of Florida and elsewhere are increasingly relying on the use of course management systems such as WebCT for the purpose of delivery of online courses. As a vendor's commercial product, WebCT is a Web-based course management system developed by the University of British Columbia (Goldberg, 1997). WebCT, a sophisticated learning management system, itself provides several features and functions that afford learning and teaching in a system-based environment by serving as a supplemental course tool/solution. In the present study, WebCT is conceptualized as an information system project and it is also considered a course management system.

Understanding student attitudes towards course management systems is important to study as student acceptance of this technology may conceivably have an impact on student use of the system in the completion of course requirements and therefore student grades. Indeed, research focused on how well psychology students respond to the use of WebCT in a Web-enhanced classroom has suggested that student grades are affected to some extent by student attitudes towards WebCT (Pan et al., 2003; Sivo, Pan, & Brophy, 2004). However, evidence of whether the relationships among factors involved in psychology student attitudes towards a course management system generalize to students of other majors has yet to be demonstrated. The assumption that student attitudes and related constructs are similar regardless of program major needs to be empirically evaluated because students in different majors arguably vary with respect to technological familiarity and expertise.

The Essential TAM

The TAM was designed to be a useful explanation of why people vary with respect to their success in using technology (Davis, 1989). According to Davis (1989), client side elements of this model include perceptions of a technology's usefulness, perceptions of a technology's ease of use, and attitudes toward the use of technology. The essential TAM proposes that these three variables work together to impact the actual use of technology in a given setting.

Figure 1. Original technology acceptance model



Specifically, a technology's perceived usefulness and ease of use jointly influence one's attitude towards the technology, which, in turn, affects a system's actual use (see Figure 1; Davis, 1993).

Previous structural equation modeling research has furnished evidence supporting the conclusion that the TAM is a parsimonious representation of how perceptions and attitudes affect actual system use (Bajaj & Nidumolu, 1998; Hu, Chau, Liu Sheng, & Yan Tam, 1999; Igbaria, Zinatelli, Cragg, & Cavaye, 1997; Mathieson, 1991; Subramanian, 1994). However, several researchers have increasingly entertained TAMs that exchange system design features with system user characteristics (Anandarajan et al., 2000; Legris et al., 2003; Pan et al., 2003; Venkatech, 2000; Wiedenbeck & Davis, 1997; Wolski & Jackson, 1999).

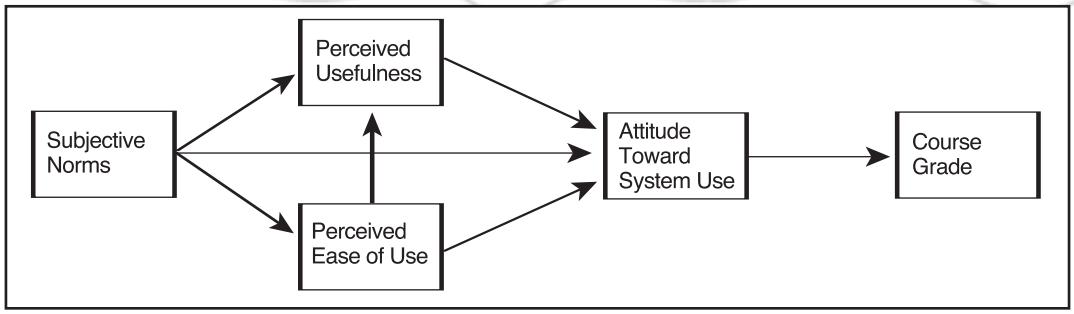
This transition in focus from system design variables to psychological variables is consistent with the nature of other variables in the model, which also focus on psychological aspects of the system user. For example, Wolski and Jackson (1999) found that within educational institutions, faculty and peer expectations are a prominent combined force in determining technology acceptance. It is not altogether surprising to find such normative influences (i.e., social pressure) at work particularly given the context in which technology acceptance is assessed. Developmentally, typical undergraduate students in the U.S. ages 18 to 22 are very susceptible to peer influence (Erikson, 1968) and, within the context of postsecondary education, students are, as well, shaped by their instructors. Indeed, the inclusion of perceived subjective norms as a psychological factor exogenous to the essential TAM continues to be a germane feature worthy of consideration (e.g., Anandarajan et al., 2000; Pan et al., 2003; Venkatech & Davis, 2000).

Pan et al. (2003) successfully replicated the TAM by identifying a causal relationship existing among students' perceived ease of use of WebCT, perceived usefulness of WebCT, their attitude toward WebCT, and their actual use of the course management system. They also succeeded in expanding the original TAM by adding subjective norms in addition to computer self-efficacy. These studies were conducted using students in a course on psychology. One of the two primary purposes of this study was to not only replicate this study with students in another psychology course, but to also contrast the TAM model results with results obtained from students in an engineering course. Factors affecting student use of a course management system (i.e., WebCT) in two large-sized, Web-enhanced, hybrid undergraduate courses was investigated. Other than the fundamental difference (i.e., course content), the two entry-level courses are compared and contrasted in Table 1.

Table 1: Comparison of Target Population by Characteristics

Characteristics	Psychology Class	Engineering Class
Textbook use	Yes	Yes
Office hours (primary)	Yes (TAs)	Yes (instructor)
Teaching assistants used	2	2
Extra credit offered	Yes	Yes
WebCT tool uses:		
Online grade	Yes	Yes
Online quizzes	Yes	Yes
WebCT mail	Yes	No
Online chatroom	Yes	Yes
Discussion forum	Yes (185 postings)	Yes (501 postings)
Content modules	Yes	Yes
WebCT calendar	Yes	No
Notes in WebCT	Yes (discussion)	Yes (PowerPoint files)
WebCT syllabus	No	Yes
Required WWW search	Yes	Yes
eCommunity use	Yes	Yes

Figure 2. The academic technology acceptance model



The outcome of interest in this case was attitudes towards system use and, secondarily, the impact of student attitudes on academic performance, operationally defined as a student's end of the course grade. This study was conducted with the permission of the psychology and engineering course instructors who supported the study by providing the grades they assigned to students at the end of the semester. The academic TAM fitted to the data is specified in Figure 2.

This model allows a direct path from the exogenous psychological variable, in this case subjective norms, to student attitude towards system use (i.e., the use of technology) because theoretically social pressure from peers and professors would have a direct effect on student attitude. In addition to subjective norms, perceptions of usefulness and ease of use are specified to jointly affect student attitudes, as these specifications are consistent with the original TAM defined by Davis (1985). For the same reason, user perception of how easy a technology is to use is specified to affect perceptions regarding the usefulness of the technology. In other words, the more strongly a student perceives a technology to be easy to use, the more strongly that student will regard the technology as useful.

The second purpose of this study was to determine whether this model is as applicable to psychology students as to engineering students. The assumption that the configuration of relationships among factors is the same for students in engineering and psychology needs to be evaluated. It is possible that the field of engineering, which has at its very heart the application of technology, draws students who, as a group, are more homogenous with respect to their comfort with technology. Though some students of psychology are likely to be comfortable with technology, it is not unreasonable to suppose that students in this major are more variable with respect to technological comfort levels relative to their peers in engineering. The academic TAM was fitted to engineering and psychology student data for the purpose of comparing the covariance structure across the two groups. The research question answered in this study was: Is the covariance structure of the academic TAM invariant (the same) across the psychology and engineering student data?

Method

Participants

This study included 460 students in both psychology (n = 230) and engineering[1] (n = 230) classes using WebCT for a Web-enhanced course. Each student completed an online questionnaire at two occasions in the spring semester of 2003. Permission to conduct this study at the University of Central Florida was provided by the engineering and psychology professors teaching the courses evaluated and the university's Institutional Review Board.

Measures

To measure subjective norms, a four-item scale that Wolski and Jackson (1999) developed was used. A sample question in the instrument included, "The instructor thinks that I should use WebCT for my course work." Furthermore, five items assessing system user attitudes toward technology were obtained from Davis (1989, 1993). A sample question in the instrument was, "All things considered, my using WebCT in my course work is: negative or positive?" Higher scores on the attitudinal scale suggested an overall more positive attitude. Results of reliability testing indicated that the alpha value for each factor was greater than .6, which suggested that adapted scales were deemed reliable (see Table 2).

[1] Initially, 237 students of the engineering class fully participated in the study. In order to have an equal number of the participants in both classes, 230 were randomly selected.

Table 2: Reliability Testing of the Scales

Scale	# of items	α
Attitude toward WebCT	5	.93
Subjective norms	4	.60
Perceived usefulness	6	.91
Perceived ease of use	6	.94

Table 3: Instruments

Attitude Toward WebCT Instrument (on a 7-point bipolar semantics scale)
Question: All things considered, my using WebCT in my course work is: 1. Bad ↔ Good. 2. Foolish ↔ Wise. 3. Unfavorable ↔ Favorable. 4. Harmful ↔ Beneficial. 5. Negative ↔ Positive.
Subjective Norms Instrument (on a 7-point Likert scale)
1. The instructor thinks that I should use WebCT for my course work. 2. My peers think that I should use WebCT for my course work. 3. Generally speaking, I would do what my instructor thinks I should do. 4. Overall, I would do what my peers think I should.
Perceived Ease of Use Instrument (on a 7-point Likert scale)
1. Learning to use WebCT would be easy for me. 2. I would find it easy to get WebCT to do what I want it to do. 3. My interaction with WebCT would be clear. 4. I would find WebCT to be flexible to interact with. 5. It would be easy for me to become skillful at using WebCT. 6. I would find WebCT easy to use.
Perceived Ease of Use Instrument (on a 7-point Likert scale)
1. Using WebCT in my class would enable me to accomplish tasks more quickly. 2. Using WebCT would improve my job performance. 3. Using WebCT in my class would increase my productivity. 4. Using WebCT would enhance my effectiveness in my course work. 5. Using WebCT would make it easier to do my course work. 6. I would find WebCT useful in my course work.

These results, while favorable, must be treated with some degree of caution given that the errors associated with linked items may be correlated and thereby overestimate the reliability estimates (Gessaroli & Folske, 2002). For more details, see Table 3.

Data Collection and Analysis Procedures

Using Dreamweaver 4, Coldfusion, and MS Access, two online questionnaires were created and administered across two time occasions: at the beginning and end of the semester. Student informed consent was used. Two weeks before each administration, a friendly reminder (pre-notice) was sent via e-mail to make sure intended participants were informed of the incoming questionnaire. WebCT's Tip feature was also used for announcement making. Additionally, teaching assistants of the course made an announcement in front of the class every time the survey was being administrated. Student participants were given a week to finish each questionnaire on a voluntary basis. Data sets from both time occasions were housed in a password-protected server.

The overall response rates (across the two occasions) for both psychology and engineering classes were 51.7% and 30.4%, respectively. Responses of students who failed to complete the questionnaire at both occasions were not considered for further analysis. Overall, female students accounted for 55.44% of the study participants and 68.44% were freshman; 68.44% were novice WebCT users. More than 70% had used the computer for more than four years.

We downloaded the data sets from the high-secured server in MS Access. The engineering and psychology professors accordingly provided to us the final course grades assigned to the students under study. The data were imported to Notepad as a text file for filtering. Then, the final copy of data was imported to LISREL for further analysis. The results were evaluated in terms of their propriety, fit, and parsimony. With this in mind, three criteria were investigated: (a) the maximum likelihood estimator should converge for properly fitting models, (b) the estimated covariance matrix should be positive definite, with no negative eigenvalues and no collinearities, and (c) the standard errors should be within proper bounds.

Specifically, the following fit indices were examined: the goodness of fit index (GFI), comparative fit index (CFI), non-normed fit index (NNFI), and the standardized root mean square residual estimate (SRMR). These indices were chosen because of their relative merits. The GFI is a stand-alone index that has a long history in SEM research. The CFI and NNFI are both incremental fit indices that indicate how much the fit of a model improves upon the nested null model. These indices are more sensitive to misspecification between latent and manifest variables relationship misspecifications (Hu & Bentler, 1999). The SRMR is more sensitive to latent-latent variable relationship misspecifications (Hu & Bentler, 1999).

An assessment of adequate fit in structural equation modeling is not without standard cutoff criteria. In part, the cutoff criteria chosen were the result of Hu and Bentler's (1999) Monte Carlo simulation findings. The GFI, CFI, and NNFI were all expected to exceed .95 if the model was to be deemed as fitting well. The SRMR was expected to attain values no higher than .05.

Results and Discussion

Is the covariance structure of the academic TAM the same across the psychology and engineering student data? A multisample analysis was conducted using LISREL. The multisample analysis using LISREL constrains the parameters of both covariances to be equal and determines whether the fit assuming these constraints is very good.

The covariances and means analyzed in this study are presented in Tables 4 and 5. Upon gross inspection, the covariances and means appear to be somewhat dissimilar, but similarities are recognizable as well. The purpose of this analysis was to determine whether the differences were of a sufficiently large magnitude to preclude a comparable fit with respect to the model.

Table 4: Covariances and Means of the Psychology Students

	PU	PEU	AT	Grades	SN
PU	53.11				
PEU	34.40	54.26			
AT	18.47	10.54	23.88		
Grades	0.11	-0.09	0.45	0.33	
SN	10.08	10.11	4.39	-0.03	13.64
Means	32.47	35.11	30.00	4.78	22.06

Note: PU = perceived usefulness; PEU = perceived ease of use; AT = attitude toward technology; SN = subjective norms.

Table 5: Covariances and Means of the Engineering Students

	PU	PEU	AT	Grades	SN
PU	57.93				
PEU	29.66	54.54			
AT	30.52	15.61	36.03		
Grades	0.67	0.67	0.74	0.44	
SN	18.60	14.88	11.96	0.14	16.32
Means	29.02	34.06	27.23	4.78	20.39

Note: PU = perceived usefulness; PEU = perceived ease of use; AT = attitude toward technology; SN = subjective norms.

Table 6: Results for the Goodness of Fit Indices

Fit Index	Value
Degrees of freedom (*df*)	6
Minimum fit function chi-square	4.75 (p = 0.58)
Goodness of fit index (GFI)	0.99
Comparative fit index (CFI)	1.00
Non-normed fit index (NNFI)	1.01
Standardized RMR (SRMR)	0.021

The maximum likelihood procedure converged to a proper solution in five iterations. The results suggest that the covariance in the responses of psychology students was very much like the covariance in the responses of the engineering students. All of the fit indices consulted suggested both models fit well and equivalently (see Table 6).

The GFI, CFI, and NNFI all exceeded .95, and the SRMR was less than .05. All fit criteria were exceeded, suggesting a magnificent fit. These results suggest that the same model is viable for both groups.

A review of the standardized path coefficients (regression weights) suggests many paths were indeed similar in value; however, notable differences could be observed as well (see Figures 3 and 4).

Both figures represent the configuration of relationships estimated for each group. A review of the parameters suggested that most of the paths specified were viable, though perceptions of how easy WebCT is to use had a negligible direct effect on attitudes toward WebCT for either groups (-.08 for psychology students; -.04, for engineering students). Furthermore, the effect of student attitudes towards WebCT on student course grades was statistically significant for either group, though small ($.02 \leq r^2 \leq .04\%$). This result suggests that regardless of whether students are in psychology or engineering, their attitudes towards WebCT plays only a minor role in their final grade. Although this result is not reassuring for this aspect of the model, it does imply that institutional concerns about how student attitudes may affect student grades may not be needed. With respect to utility of the academic TAM, perhaps outcome(s) variables other than course grades

Figure 3. Psychology student data

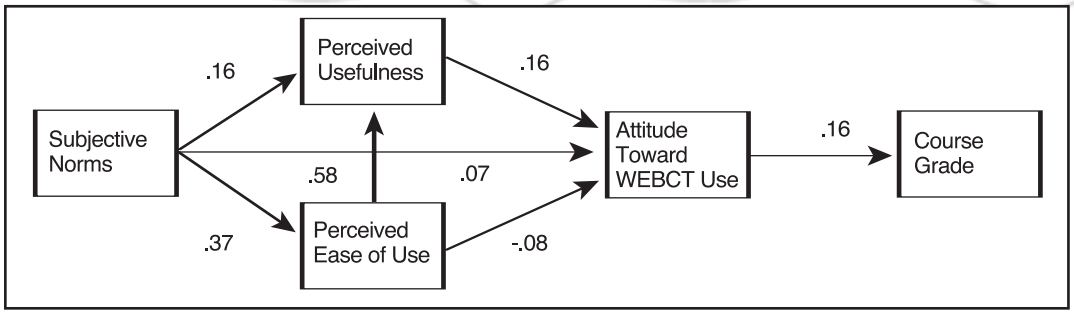
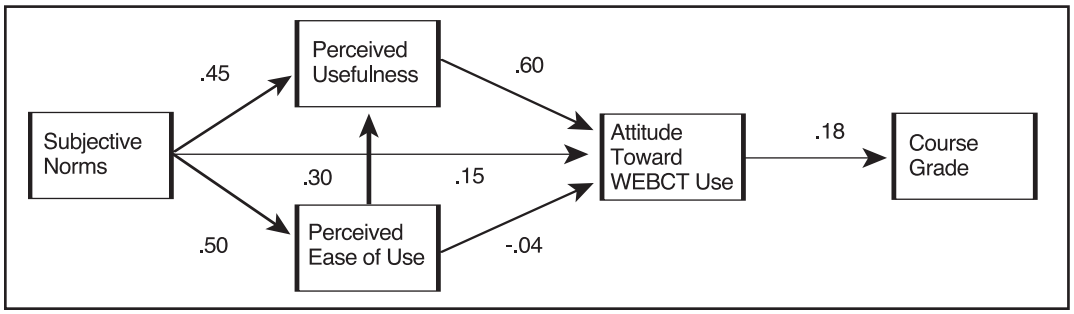


Figure 4. Engineering student data



should be considered such as frequency of technology use or the duration of technology use. Just how much do students' attitudes affect their exploitation of the technological resources made available to them and at what price?

To facilitate a further comparison of these paths, corresponding coefficients across the two path models are juxtaposed in Table 7.

A comparison of the differential effects of variables revealed that the influence of peer pressure and professorial expectations (subjective norms) were stronger for engineering students than for psychology students. For instance, the effect of subjective norms on student perceptions of how easy WebCT is to use was notably greater for engineering students (_ = .50) than psychology students (_ = .37). Subjective norms also had a stronger impact for engineering students on perceptions of how useful WebCT is as a course management system (_= .45) than for psychology students (_= .16). Similarly, subjective norms influenced engineering student attitudes towards WebCT (_= .15) more than psychology student attitudes (_= .07), although the coefficients were smaller. These results may be due to the engineering professor tending to hold his office hours primarily by himself and therefore having relatively more opportunities than the psychology professor to exert his influence in student perception of the WebCT use and student attitude toward the technology use. Conversely, psychology student perceptions of how easy WebCT is to use had a stronger effect on their perceptions of how useful WebCT is (_= .58) than engineering student perceptions (_= .30). These results may be due because of the limited social influence (or pressure) by the instructor, the psychology students behaved more like regular end users of a technology system, where they believed that WebCT had to be easy to use before they started to feel it is useful to their coursework (and then favored WebCT). Overall, these results suggest that although the same path model is viable for engineering and psychology students, differences in the two groups exist in the strength of certain effects.

The ultimate goal of this study was to assist the University of Central Florida in offering an alternative educational medium and a nontraditional paradigm to tailor customized instruction for the purpose of better suiting the wide variety of University of Central Florida students. Though the response rate of the engineering class was not noticeably high, the significance of this study may provide administrators from similar settings with insights into users' perception about the system employed from two different disciplines, which may mediate the acceptance of such technology.

Table 6: Academic TAM Path Values for Psychology and Engineering Students

	Standardized Paths (_s)	
	Psychology	**Engineering**
Subjective norms → Perceived usefulness	.16	.45
Subjective norms → Perceived ease of use	.37	.50
Subjective norms → Attitudes towards WebCT use	.07	.15
Perceived ease of use → Perceived usefulness	.58	.30
Perceived ease of use → Attitudes towards WebCT use	-.08	-.04
Perceived usefulness → Attitudes towards WebCT use	.55	.60
Attitudes towards WebCT use → Course grades	.16	.18

These results suggest that the academic TAM is as applicable to engineering students as it is to psychology students with respect to WebCT as a course management system, although perceptions of peer pressure and professor expectations play a more prominent role for engineering students and perceptions of WebCT ease of use has a greater impact on psychology students. If it is the goal of an institution to build student acceptance of a course management system, if for no other reason than to secure student satisfaction, then these results suggest that interventions should vary by the course sequence students are designated to take. Programmatically, this is useful because the relative strength of variable relationships at play in determining student attitudes towards technology is not the same. Specific recommendations of what programmatic strategies might be considered are not possible at this point, though this study does further develop our understanding of some of the dynamics. It is important to note that interventions designed to increase student attitudes towards technology should consider how a change in attitude would benefit students in academic ways beyond course grades. This research suggests that attitudes towards technology only play a minor role in affecting final grades.

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Books Briefly Noted

Cathcart, B. (2004). *The fly in the cathedral: How a small group of Cambridge scientists won the race to split the atom*. London, UK: Viking Press. ISBN: 0-670-88321-2, CAN $34.00 (Not available in US).

The book in your hand is mostly empty space. Each of the billions of atoms that make it up is hollow, its true mass concentrated in a tiny core which, if the atom were a cathedral, it would be no bigger than a fly.

Three quarters of a century ago no one could describe the atomic nucleus. Discovering its existence was Lord Rutherford's greatest scientific achievement but even he caught only a glimpse. Incapable of stopping there, he ached to know more – to catch the fly, examine it, dissect it and illuminate its mystery.

For a time all efforts to crack it open were stalled. No theory was possible until it could be tamed experimentally and no experiment seemed feasible since it guarded its secrets so fiercely. Then, just at the point of despair, John Cockcroft and Ernest Walton, two young researchers in a grubby basement room at the Cavendish Laboratory in Cambridge, came under Rutherford's guidance. And, with paper-and-pencil calculations, hand-made apparatus and the odd lump of plasticine, they changed everything.

Recreating the frustrations, excitements and obsessions of 1932, the 'miracle year' of British physicists, *The Fly in the Cathedral* reveals the astonishing story behind the splitting of the atom – the most celebrated scientific experiment of its time. Involving intense international competition, a cast of Nobel prize-winners, a few silly experiments and some revolutionary physics, Brian Cathcart's lucid, learned, high-voltage narrative is inspired by the dreams and endeavor that led the last true gentlemen scientists to the very essence of the universe: the heart of matter.

Cornish, E. (2004). *Futuring: The exploration of the future*. Bethesda, MD: World Future Society. ISBN: 0-930242-57-2, $29.95 (Hardcover).

This comprehensive guide to the study of the future, written by Edward Cornish, president of the World Future Society and editor of *The Futurist* magazine, is an essential and indispensable tool for anyone interested in the future.

Futuring is an authoritative introduction to scientific thinking about the future. Written in a clear, readable style, *Futuring* explains what we know about the future and what we can't, some of the techniques used by futurists, and the role that forward-looking people can play in creating a better tomorrow.

Cornish describes specific methods for anticipating future events so that readers can prepare to seize emerging opportunities and avoid unnecessary problems. *Futuring* can help readers make better decisions, develop worthwhile goals, and find the means to achieve them. *Futuring* is a powerful tool for achieving a better future.

Futuring also explains how serious thinking about the future has changed through the years, including the development of the idea of progress in the 17th century, the disillusionment with progress in the 20th century, and recent developments in thinking creatively and practically about the future. Readers will learn how far-sighted business trend watchers, military planners, and think-tank scholars now have a growing number of ways to think scientifically about the future so that leaders in government and business can prepare for opportunities and risks ahead. Cornish explains how these new methods are being used and how you too can use many of these methods in simplified but useful forms.

Davis, L.J. (2003). *Fleet fire: Thomas Edison and the pioneers of the electronic revolution*. New York, NY: Arcade Publishing. ISBN: 1-55970-655-4, $27.95.

The electric revolution, which eclipsed the Industrial Revolution by the end of the nineteenth century and continues to this day, changed our world forever. *Fleet Fire* tells us how it all began. In this entertaining narrative, science writer L.J. Davis introduces us to the men behind both the stunning successes and forgotten failures. Among them are Benjamin Franklin, whose kite first

ignited the spark of curiosity; Alessandro Volta, who invented the storage battery; Joseph Henry, who gave us the electromagnet; Thomas Davenport, the electric motor; Samuel Morse, the electromagnetic telegraph; Cyrus Field, the transatlantic cable; Thomas Edison, the phonograph and electric light; and Nikola Tesla and Guglielmo Marconi, who raced frantically against each other to create the radio. Though in retrospect these devices may seem simple, they revolutionized the way we work and, more important, the way we view the world by redefining our concept of time and space.

Thoroughly researched and engagingly written, *Fleet Fire* shines a bright new light on the formative years of the electric revolution, capturing one of the most creative periods of experimentation and discovery, an inventive epoch unmatched in history.

Dean, T. (2004). *Talking with computers: Explorations in the Science and Technology of computing*. NY: Cambridge University Press. ISBN: 0-521-54204-9, $30.00.

In this lively series of essays, Tom Dean, Professor of Computer Sciences at Brown University and a Fellow of AAAI, explores interesting fundamental topics in computer science with the aim of showing how computers and computer programs work and how the various subfields of computer science are connected. Along the way, he conveys his fascination with computers and enthusiasm for working in a field that has changed almost every aspect of our daily lives.

The essays touch on a wide range of topics, from digital logic and machine language to artificial intelligence and searching the World Wide Web, considering such questions as:

- How can a computer learn to recognize junk email?
- What happens when you click on a link in a browser?
- How can you program a robot to do two things at once?
- Are there limits on what computers can do?

The author invites readers to experiment with short programs written in several languages. Through these interactions he grounds the models and metaphors of computer science and makes the underlying computational ideas more concrete. The accompanying website www.cs.brown.edu/~tld/talk provides easy access to code fragments from the book, tips on finding and installing software, links to online resources, exercises, and sample lectures.

DeGregori, T.R. (2002). *Bountiful harvest: Technology, food safety and the environment*. Washington, DC: The Cato Institute. ISBN: 1-930865-31-7, $12.95.

Millions of lives have been saved from malaria and typhus - two of the world's greatest killers - by DDT, a chemical that anti-technology groups in the United States managed to get banned. Yet these same groups oppose regulation of products with proven toxicity-for example, organic foods and alternative medicines-but this contradiction does not seem to bother them. Bountiful Harvest debunks these myths about the dangers of technology.

Arguing that humans are inherently technological beings and that technology has supported immense human progress over the past century, author DeGregori, who is a professor of economics at the University of Houston, provides a resounding critique of the modern Greens, vegetarians, organic and natural food advocates, and critics of genetically modified foods.

Doeringer, P., Evans-Klock, C. & Terkla, D.G. (2002). *Start-up factories: High-performance management, job quality, and regional advantage*. NY: Oxford University Press and Kalamazoo, MI: W.E. Upjohn Institute for Employment Research. ISBN: 0-19-514747-2, $24.50.

Start-Up Factories charts the experience of start-up factories in adopting high performance management practices and provides insights into how U.S. manufacturing can improve labor productivity and job quality in the coming years. Based on an extensive study of 48 new branch plants – with both U.S. and Japanese parent companies – that began operating between 1978 and 1990, this book explains how best practice manufacturing companies are raising productivity and lowering unit costs by introducing innovative high performance management practices.

Start-Up Factories answers six key questions related to high performance management practices in the American workplace and provides criteria for evaluating certain strategies:

- To what extent do the newest and technologically most advanced manufacturing plants adopt high performance management practices?
- Are there complementarities among these practices?
- Is there a single "best practice" model of high performance management being used by top-performing plants?
- Do high performance management practices contribute to jobs of high quality?
- Are there unique regional characteristics that reinforce high performance workplace standards?
- How can factories that combine state-of-the-art technologies with comprehensive high performance management strategies generate a large competitive advantage?

This book demonstrates to economists, labor and management professionals, and policymakers that there is a set of principles about how to rebuild management systems in ways that simultaneously provide higher rates of growth in business productivity and a greater sharing of these productivity gains with workers.

Fuhrman, S.H. & Elmore, R.F. (2004). *Redesigning accountability systems for education*. NY: Teachers College Press. ISBN: 0-8077-4425-5, $45.00,

Now more than ever, policymakers face a number of difficult and technical questions in the design and implementation of new accountability approaches. This book gathers the emerging knowledge and lessons learned offered by leading scholars in the field to provide an invaluable resource for policymakers, educators, and anyone interested in the pressing issue of accountability and public schools.

Expert contributors examine and offer recommendations on crucial issues such as:

- The effect of accountability policies on the ability of schools to improve over time.
- The significant variation in the design and effect of accountability systems in different states.
- The validity of assessment measures, including the use of scores for high-stakes decisions about students and schools.
- The choice of accountability measures and the levels of progress to expect.
- How to avoid penalizing schools for socioeconomic problems and other factors out of their control.
- The use of multiple measures of student achievement.
- Inclusion of students with disabilities and limited English proficiency in accountability systems.
- Building teachers' capacity to use information provided by assessments to improve instruction.

Gordin, M.D. (2004). *A well-ordered thing: Dmitrii Mendeleev and the shadow of the periodic table*. New York, NY: Basic Books. ISBN: 0-465-02775-x, $30.00.

When a young Dmitrii Mendeleev drafted the Periodic Table of Elements as a guide for his chemistry students at St. Petersburg University, he already had dreams of building a unified scientific empire in his home of Russia, with a place for himself in the limelight.

That the Periodic Table predicted the existence of three unknown elements and became the framework for modern chemistry helped Mendeleev's cause; it gave him a platform for social change and sensationalism. When he battled the emergence of Spiritualism in Russia, playing the skeptical foil in the séances he attended, newspapers across St. Petersburg paid attention. When he ventured into the sky as the novice pilot of a hot-air balloon, it made meteorology noteworthy in Russia. His attempts to distill a pure "ether" from the earth's atmosphere were similarly brave, but that chemical prophecy turned out to be less inspired.

Mendeleev's relationship with the Russian establishment was equally turbulent. He was an advisor to the Tsar, vitriolic proponent of protectionism, and he later introduced the metric system to the Russian empire. But his dramatic rejection at the hands of the Russian Academy of Sciences sent him into a tailspin that saw him spend his later years clawing to hold onto the reputation he established in his youth, while trying to reinvent himself as a scientific legend, a

Siberian Isaac Newton. Mendeleev was a loyal subject of the Tsar, but he was also a maverick who thought that only an outsider could perfect a modern Russia. He wanted to remake Russia just as he had remade chemistry, and his successes – and failures – were significant.

And yet, Mendeleev may be the most important scientist about whom we have almost nothing in English – until now, that is. In *A Well-Ordered Thing*, historian and Princeton assistant professor Michael Gordin changes that, drawing a portrait of the man in three full dimensions. A clever and detailed portrait of a man who had nearly been lost to history, *A Well-Ordered Thing* is a fascinating journey into the world of Imperial Russia – and into the life of one of its most notorious minds.

Gusterson, H. (2004). *People of the bomb: Portraits of America's nuclear complex*. Minneapolis, MN: University of Minnesota Press. ISBN: 0-8166-3860-8, $19.95.

This book tells the story of how – like it or not, know it or not – we have become "the people of the bomb." Integrating fifteen years of field research at weapons laboratories across the United States with discussion of popular movies, political speeches, media coverage of war, and the literature of defense intellectuals. Hugh Gusterson, associate professor of anthropology and science studies at MIT, shows how the military-industrial complex has built consent for its programs and transformed our public culture and personal psychology since we entered the nuclear age.

Hakken, D. (2003). *The knowledge landscapes of cyberspace*. New York, NY: Routledge. ISBN: 0-415-94509-7, $24.95.

The Knowledge Landscapes of Cyberspace is a provocative and pioneering analysis of information technology from a humanistic perspective. David Hakken – a leading anthropologist of computer culture and Professor of Anthropology and Director of the Policy Center at the State University of New York Institute of Technology at Utica/Rome – examines some fundamental about the cultural impact of cyberspace: Is the character or social function of knowledge changed profoundly – so profoundly as to justify terms like "Knowledge Society"? How are knowledge technologies tied to various agendas and forms of power?

In this richly documented and powerfully argued work, Hakken outlines a fresh way of thinking about the dynamics of technology and offers a new anthropologically-informed method of studying cyberspace from a cultural perspective. He also investigates the political economy of knowledge in cyberspace, and responds to the many aesthetic, ethical and political questions posed by uses and abuses of information technology.

This book is essential reading for anyone seeking to understand the human implications of the so-called computer revolution.

Hart, J.F. (2003). *The changing scale of American agriculture*. Charlottesville, VA: University of Virginia Press. ISBN: 0-8139-2229-1, $37.50.

Few Americans know much about contemporary farming, which has evolved dramatically over the past few decades. In *The Changing Scale of American Agriculture*, the award-winning geographer and landscape historian John Fraser Hart describes the transformation of farming from mid-twentieth century, when small family farms were still viable, to the present, when a farm must sell at least $250,000 of farm products each year to provide an acceptable standard of living for a family.

The increased scale of agriculture has outmoded the Jeffersonian ideal of small, self-sufficient farms. In the past farmers kept a variety of livestock and grew several crops, but modern family farms have become highly specialized in producing a single type of livestock or one or two crops. As farms have become larger and more specialized, their number has declined.

Hart contends that modern family farms need to become integrated into tightly orchestrated food-supply chains in order to thrive, and these complex new organizations of large-scale production require managerial skills of the highest order. According to Hart, this trend is not only inevitable, but it is beneficial, because it produces the food American consumers want to buy at prices they can afford.

Although Hart provides the statistics and clear analysis such a study requires, his book focuses on interviews with farmers: those who have shifted from mixed crop-and-livestock farming to cash-grain farming in the Midwest agricultural heartland; beef, dairy, chicken, egg, turkey, and hog producers around the periphery of the heartland; and specialty crop producers on the East and West Coasts. The invaluable case studies bring the reader into personal contact with the entrepreneurs who are changing American agriculture. Hart believes that modern large-scale farmers have been criticized unfairly and *The Changing Scale of American Agriculture*, the result of decades of research, is his attempt to tell their side of the story.

Heilbrun, M. (2000). *Inventing the skyline: The architecture of Cass Gilbert*. New York, NY: Columbia University Press. ISBN: 0-231-11873-2, $20.00.

Designed by the architect of the Broadway Chambers Building, the US Custom House, the Minnesota State Capitol, the St. Louis Art Museum, and large-scale projects like the city plan for New Haven, Connecticut, Cass Gilbert's pioneering skyscrapers – "symbols of our national genius and unrestraint" – profoundly influenced architects during the first decades of the twentieth century and epitomize the Beaux Arts "City Beautiful" aesthetic he embraced throughout his career. Containing essays by major Gilbert scholars, this lavishly illustrated volume considers the full breadth of Gilbert's career. The book also documents fascinating details about the buildings: the color scheme of the main entrance of the Minnesota State Capitol, made to resemble the Byzantine tombs of Galla Placidia in Ravenna; the controversy that erupted over the use of female nudes on the relief of the Essex County Courthouse; and the ill-fated plans for the George Washington Bridge as a Beaux Arts monument with elaborate plazas, fountains, and sculptures.

Hocker, F.M. & Ward, C.A. (2004). *The philosophy of shipbuilding: Conceptual approaches to the study of wooden ships*. College Station, TX: Texas A&M University Press. ISBN: 1585443131, $75.00.

No boat or shipbuilder has ever started from scratch. Skilled craftsmen construct vessels based on a combination of their own skills and those of their predecessors, and these techniques tell how people of the past, from ancient Egypt's First Dynasty to North America's Golden Age of Navigation, perceived the physical world.

Edited by Frederick M. Hocker and Cheryl A. Ward, who both received their PhDs from Texas A&M University, *The Philosophy of Shipbuilding: Conceptual Approaches to the Study of Wooden Ships* explores the concepts underlying basic ship design and construction during various periods of history. Experts in the field study ancient boat models, present the latest research methodologies, and furnish information from nautical archaeology excavations.

"The study of ship remains begins with the recording of seemingly trivial details: the thickness of a plank, the numbers and sizes of nails, the direction of an adze stroke, the color and texture of stains in half-rotten bits of wood," Hocker writes. "Those tool marks and stains, grain patterns and botched repairs, are the voices of the people who owned, built, and sailed the vessels archaeologists excavate and ship specialists study. Their voices can tell us who they were and why they built their boats and ships the way they did."

The first essays explore the earliest plank-built ships of ancient Egypt and the evidence contained in Egyptian papyri, the mortise-and-tenon joined hulls of the ancient Mediterranean, and principles and methods of construction used in ancient naval architecture. Further chapters discuss Nordic clinker construction, bottom-based shipbuilding in northwestern Europe, and Nile skippers of the mid-third century B.C. A wide range of ships is examined, including those from the third millennium B.C., the Tantura wrecks, and Iberian ships from the fifteenth and sixteenth centuries. A final chapter examines the evolution of Lake Champlain's sailing merchant fleet.

Hood, Clifton (2004). *722 miles: The building of the subways and how they transformed New York centennial edition*. Baltimore, MD: Johns Hopkins University Press. ISBN 0-8018-8054-8, $18.95.

The 22 miles, from City Hall to 145th Street and Lenox Avenue, was once considered a

remarkable engineering feat. By the 1940s, the New York City subway system grew to 722 miles, including the Independent Subway line. In the process, the subway system transformed New York. In this definitive history, Clifton Hood traces the complex and fascinating story of the New York City subway system, one of the urban engineering marvels of the twentieth century. For the subway's centennial the author supplies a new foreword explaining that now, after a century, "we can see more clearly than ever that this rapid transit system is among the twentieth century's greatest achievements."

Hosek, J.R., Mattock, M.G., Fair, C.F., Kavanagh, J., Sharp, J., Totten, M. (2004). *Attracting the best: How the military competes for information technology personnel*. Arlington, VA: RAND National Defense Research Institute. ISBN: 0-8330-3550-9, $27.50.

During the 1990s, the private-sector demand for information technology (IT) workers, escalating private-sector pay in IT, growing military dependence on IT, and faltering military recruiting led to a concern that the military capability was vulnerable to a shortfall in IT personnel. This report addresses that concern by use of a literature description, field interviews, data analysis, and a dynamic model that, taken together, offer some policy implications for military planners in terms of how to recruit and retain qualified IT personnel.

Hughes, T. P. (2004). Human-built world: How to think about technology and culture. Chicago, IL: The University of Chicago Press. ISBN: 0-226-35933-6, $22.50.

Technology surrounds us: Millions of homes have digital cable and wireless internet connections; telephones can also serve as cameras, music players, and personal organizers; and everything from stereos to computers grow more sophisticated every year. This, of course, is the technology that most of us encounter and even embrace. But lurking behind these gadgets is an arena in which the topic of technology raises troubling questions. Cosmetic surgery, chemical weapons, and cloning are just some of the more recent examples of the uneasy results of our technological progress, and they remind us that technology is Janus-faced – something capable of immeasurable good as well as a test of the limits of human morality and power.

Thomas P. Hughes, the eminent historian of technology and acclaimed author of *American Genesis*, a finalist for the Pulitzer Prize, wrote *Human-Built World* as a similar reminder, revealing the concept of technology as it was framed historically by thinkers who ran the gamut from horrified to euphoric. For just as Henry Ford's factories were revolutionizing the productive capacity of the American automobile industry, social critics were warning of the increasing "dehumanization" of machine-age culture. And just as Ralph Waldo Emerson was celebrating the transformative power of technology and its ability to express the ultimate creativity of the human race, the steam engine and coal production were beginning to ravage the nineteenth-century landscape.

Exploring such competing perspectives, *Human-Built World* is a concise intellectual biography of the tools of technology. Drawing on a vast body of work created over the centuries by philosophers and architects, social theorists and web designers, politicians and engineers, Hughes charts the multiple ways that technology has been viewed – sometimes with elation, sometimes with skepticism – by various thinkers. Technology, as he shows here, has not been a slow and steady march to the ever-increasing complexity and sophistication of objects; it has been the subject of debate for centuries about the human will to create, the inherent danger of progress for its own sake, and the Mephistophelean urge to alter everything from the natural landscape to the daily activities of millions. "In its variety," Hughes writes here, "technology is full of contradictions, laden with human folly, saved by occasional benign deeds, and rich with unintended consequences." Hughes' mission here is to restore to technology these contradictions and unintended consequences, and his *Human-Built World* is a necessary and original guide that recreates technology as the philosophical, moral, and social dilemma it rightfully is.

Jackson, W. J. (2004). *Heaven's fractal net: Retrieving lost visions in the humanities*. Bloomington: Indiana University Press. ISBN: 0-253-21620-6, $29.95.

"Fractal" is a term coined by mathematician Benoit B. Mandelbrot to denote geometry of nature, which traces inherent order in chaotic shapes and processes. Using lines so intricate they

are more than one-dimensional and surfaces so rough they are more than two-dimensional, fractal geometry can articulate new ways of considering and describing nature. In the recursive patterns of religious music, in temple architecture in India, in cathedral structures in Europe and America, in the imagery of religious literature depicting infinity and abundance, and in poetic descriptions of the nature of consciousness, fractal-like configurations are pervasive. Fractal concepts are part of our emerging vocabulary and can describe patterns of human behavior, culture and history while enhancing our understanding of the nature of consciousness.

Karoly, L.A. & Panis, C.W.A. (2004). *The 21st century at work: Forces shaping the future workforce and workplace in the United States*. Arlington, VA: RAND Labor and Population. ISBN: 0-8330-3492-8, $30.00.

What are the forces that will continue to shape the US workforce and workplace over the next 10 to 15 years? With such inevitabilities as the proliferation and acceleration of technology worldwide, will more individuals work at home, will more businesses outsource their noncore functions – and with what consequences? Answering such questions can help stakeholders – workers, employers, educators, and policymakers – make informed decisions. With its eye on forming sound policy, the US Department of Labor asked the RAND Corporation to look at the future of work in the near-to-medium term. The authors analyzed shifting demographic patterns, the pace of technological change, and the path of economic globalization. They observe, for example, that the workforce will continue to grow – however, at a markedly declining pace – and that the ongoing education of employees will be paramount as new technologies, such as bio- and nanotechnologies, come onto the scene and develop. They also look at the trend of globalization and how it fares for the United States' economy and those of other countries. Overall, the authors provide for the reader expectations about the key forces in the economy today and their implications for the future workforce and workplace, including the size, composition, and skills of the workforce; the nature of work and workplace agreements; and worker compensation.

Kent, P. (2004). *Search engine optimization for dummies*. NY: Wiley Publishing, Inc. ISBN: 0-7645-6758-6, $24.99.

Find out how to make your site pop to the top when the search is on. Search engines, search directories, search systems – it's enough to make you search for antacids! Well, relax – this book not only tells you which is which, it gives you the inside track on which ones to impress. Find out about pay-per-click search engine advertising, what your site needs to lure search engines, how and where to register, and more.

Krebs, R.E. (2004). *Groundbreaking scientific experiments, inventions & discoveries of the Middle Ages and the Renaissance.* Westport, CT: Greenwood Press. ISBN: 0-313-32433-6, $65.00.

The Middle Ages and the Renaissance were a period of scientific and literary awakening. Scientific development and a renewed interest in classical science led to new discoveries, inventions, and technologies. Between 500 and 1600A.D., scientific explorers rediscovered ancient Greek and Eastern knowledge, which led to an eruption of fresh ideas. This reference work describes more than 75 experiments, inventions, and discoveries of the period, as well as the scientists, physicians, and scholars responsible for them. Individuals such as Leonardo da Vinci, Marco Polo, and Galileo are included, along with entries on reconstructive surgery, Stonehenge, eyeglasses, the microscope, and the discovery of smallpox.

Part of a unique series that ranges from ancient times to the 20th century, this exploration of scientific advancements during the Middle Ages and the Renaissance will be useful to high school and college students, teachers, and general readers seeking information about significant advances in scientific history.

Launius, R.D. & Daly Bednarek, J.R. (2003). *Reconsidering a century of flight*. Chapel Hill, NC: The University of North Carolina Press. ISBN: 0-8078-5488-3, $19.95.

On December 17, 1903, Orville and Wilbur Wright soared into history during a twelve-second flight on a secluded North Carolina beach. Commemorating the 100th anniversary

of the first flight, these essays chart the central role that aviation played in twentieth-century history and capture the spirit of innovation and adventure that has characterized the history of flight.

The contributors, all leading aerospace historians, consider four broad themes relating to the development of flight technology: innovation and the technology of flight, civil aeronautics and government policy, aerial warfare, and aviation in the American imagination. Through their attention to the political, economic, military, and cultural history of flight, the authors establish that the Wrights' invention – and all that followed in both air and space – was one of the most significant technologies of the twentieth century, fundamentally reshaping our world.

Levick, S.E. (2004). *Clone being: Exploring the psychological and social dimensions*. NY: Rowman & Littlefield Publishers, Inc. ISBN: 0-7425-2990-8, $28.95.

Marshalling psychological and sociological theory and research, and drawing upon extensive clinical experience as a psychiatrist and psychotherapist, Levick explores the various dimensions of cloning. This book attempts to anticipate the possible consequences of cloning for a clone, his or her "parents" and family, and society. Levick, who is also a clinical assistant professor of psychiatry at the University of Pennsylvania School of Medicine, does this through models of situations that are relevant by analogy to various aspects of cloning. Psychotherapy case material enlivens and illustrates each model, and the reader is helped to identify "clone-like" aspects of his or her own experience and mental life, and also to see evidence of the clone-like around them. Through this process, the book comes to important conclusions about human nature, including the crucial roles of intimacy, sex and sexuality for society. The clinical and scientifically grounded insights of this book should help inform the reader's ethical judgments and attitudes about the reproductive cloning of human beings.

Lottman, H. (2004). *The Michelin men: Driving an empire*. New York, NY: I.B. Tauris. ISBN: 1-86064-896-7, $27.95.

Herbert Lottman is an American writer based in Paris and is the European correspondent for *Publishers Weekly.* In his new book, *The Michelin Men: Driving an Empire* he offers the previously untold account of the Michelin dynasty – one of the world's most successful and secretive companies – and the inside story of the Michelin hotel and restaurant guides, as well as their tires, both products that revolutionized the way people travel today.

Andre and Edouard were two brothers trying to rescue their family's family rubber plant in Clermont-Ferrand, France. After repairing a faulty tire as a favor, Edouard became determined to design a superior one. Deciding to pursue the business, Andre, who was based in Paris, began a public relations campaign. Trying to convince the public that riding on a cushion of air was the more comfortable way to travel, he came up with the phrase that the Michelin tire "swallows the obstacle." That slogan would give name to Bibendum, the endearing and immediately recognizable tire man. Back in the factory, Edouard's management style and focus on innovation kept the Michelin brand ahead of the competitors. At the same time Andre, defending the company in his weekly promotional articles, prepared a free travel guide touting Michelin tires, which would encourage motorists to explore the countryside. The free guides grew in popularity and the Paris travel office, which offered free route plans, began to become a business of its own.

The company grew from its success, but as competitors entered the fray, the Michelin men began protecting their empire. Whether a factory worker or a guide inspector, all staff were required not to reveal company secrets – with good reason, Lottman tells just how far some people would go to get the world-renowned three star designation for their restaurant. The Michelins were also protecting plans for a radial tire that would revolutionize the tire industry for the latter half of the twentieth century. They even managed to keep their plans secret from the Germans during the Occupation. However, the company faced another hurdle when Francois Michelin took the helm of the company in 1959. He stressed that the company needed to expand into the international marketplace to remain viable. Through intense criticism and economic ups and downs, he remained convinced of his long-term plan. In the end proving his critics wrong, Lottman describes how Francois made Michelin one of the most successful worldwide companies.

With Herbert Lottman's skillful narration, *The Michelin Men* tells how two brothers saved their family's company, created an international industry, and invented the world's best guidebooks to promote their tires. In the process, he gives readers a history of the automobile and travel industries, and how Michelin revolutionized them both.

Livingstone, D.N. (2003). *Putting science in its place: Geographies of scientific knowledge.* Chicago, IL: The University of Chicago Press. ISBN: 0-226-48722-9, $27.50.

As any fan of Patrick O'Brian's series devoted to the voyages of Captain Jack Aubrey and Stephen Maturin knows, part of the appeal of books is the vivid descriptions of Maturin's botanic and scientific labors and discoveries during the course of the series. The character of Maturin is based on the historical figure of the seafaring scientist, encountering new species, collecting specimens, and bringing his researches home to a fascinated public. But while we recognize Maturin as fictional, we forget that the work of the men he represents is conditioned by time and place as the recent "Master and Commander" movie demonstrated. Science, far from a universal pursuit, always has a setting, and this setting in turn affects the shapes of scientific discoveries.

David N. Livingstone's *Putting Science in Its Place* is an elegant, concise story of how science has been affected by its setting. As Livingstone, who is professor of geography and intellectual history at Queen's University in Belfast, points out, landmark discoveries have been made not only on boats but also in asylums, in royal gardens that served as the home of exotic animals, on living and dead bodies, and in sterile laboratories. All of these places – and more – have made their mark in determining the questions that scientists have been able to ask and answer. Livingstone's narrative charts the ways that place and space have organized science, bringing the latter fully into discussion with social and political history.

Livingstone, a fellow of the British Academy and member of the Royal Irish Academy, does not restrict himself solely to place. Measurement, for example, has a history, as does representation. The advent of photography, the invention of the metric system, even the relative wealth of nineteenth-century "gentleman scientists" are all connected to the scientific enterprise. *Putting Science in Its Place* fills out this necessary context for understanding the history of human discovery and invention. "Scientific knowledge", Livingstone writes, "is always the product of specific spaces. To claim otherwise is to displace science from the culture of which it is so profoundly a part."

Putting Science in Its Place is a fascinating view of how science is specific and local. While it may make claims to universality, Livingstone shows, science is as much a product of place and time as operas and politics, technology and travel. He reminds us in accessible language and through fascinating examples. This clear, thought-provoking book brings the scientific endeavor back from the lofty realm of the abstract and situates it solidly in the historical circumstances from which it emerged. In the process, a geography of science is born.

May, W.F. (2001). *Beleaguered rulers: The public obligation of the professional*. Louisville, KY: Westminster John Knox Press. ISBN: 0-664-22671-X,$19.95.

Professionals today wield an enormous public power. Collectively, their decisions affect the patient's plight, the client's fate, the student's future, the city's scape, the earth's sustainability, the worker's fair treatment, and the durability of institutions great and small. Yet professionals do not perceive themselves as power wielders. They feel beleaguered, marginal, insufficiently appreciated, often under siege. Thus they tend to obscure for themselves their obligations to the common good. This book explores eight professions as their struggle with their double identity – as a means to a livelihood and as a "common calling in the spirit of public service." An interpretation of American culture emerges from its pages, as social critic and Professor of Ethics at Southern Methodist University William May opens up the ways in which each profession answers to something deep in the American spirit.

Misa, T.J. (2004). *Leonardo to the internet: Technology & culture from the Renaissance to the present.* Baltimore, MD: The Johns Hopkins University Press. ISBN: 0-8018-7809-8, $19.95.

The image of the lone inventor transforming society from the outside has a strong hold on the public's imagination. In reality, though, technologies are products of ongoing social and cultural processes. In *Leonardo to the Internet*, historian and associate professor of history at the Illinois Institute of Technology Thomas J. Misa provides a sweeping comparative history of the interrelationship between technology and society since the Renaissance, revealing how technological innovations have been shaped by the cultures in which they arose and how such technologies have, in turn, shaped these cultures. From the careers and contributions of the Renaissance court inventors Johann Gutenberg and Leonardo da Vinci to beer brewing in industrial London to the telecommunication revolution of the late twentieth century, Misa uses carefully chosen and engagingly told case studies to develop his thesis.

Over eight thematic chapters, Misa provides detailed portraits of the inventors and users of technologies. Beginning his narrative at the dawn of the "modern" era, Misa surveys the intersections of technology, politics, and culture in the Renaissance court system of Western Europe; the role of technology in Holland's commercial expansion; the diverse "paths" to and through Britain's industrial revolution; the links among technology, imperialism, and trade in the nineteenth century; and the application of scientific discoveries in chemistry and physics to industry in Germany and the United States at the turn of the twentieth century. Misa then examines the introduction of mass-produced consumer goods and their impact on daily life and modernist sensibilities, the rise of the military-industrial complex during World War II, the technological innovations generated by the command-and-control economics of the Cold War, and the emergence of a technology-oriented global culture since the 1970s. The work concludes with a provocative essay laying out the technological choices we face today and considering their impact on the type of society we wish for the future.

A masterful analysis of the ways in which technology and culture have influenced each other over five centuries, *Leonardo to the Internet* encourages students and general readers alike to think both more widely and more deeply about the invention, development, transfer, and adaptation of technologies within Western civilization.

Mitchell, R. & Thurtle, P. (2004). *Data made flesh.* New York, NY: Routledge. ISBN: 0-415-96905-0, $24.60.

In an age of cloning, cyborgs, and biotechnology, the line between bodies and bytes seems to be disappearing. *Data Made Flesh* is the first collection to address the increasingly important links between information and embodiment, at a moment when we are routinely tempted, in the words of Donna Haraway, "to be raptured out of the bodies that matter in the lust for information," whether in the rush to complete the Human Genome Project or in the race to clone a human being. From cybernetics to genomics, this timely collection is essential reading for anyone interested in the fate of the body at the cutting edge of technology.

Mom, G. (2004). *The electric vehicle: Technology and expectations in the automobile Age.* Baltimore, MD: The Johns Hopkins University Press. ISBN: 0-8018-7138-7, $54.95.

Recent attention to hybrid cars that run on both gasoline and batteries has made the electric car an apparent alternative to the internal combustion engine and all of its attendant environmental costs and geopolitical implications. Yet few people realize that the electric car – neither a recent invention nor a historical curiosity – has a story as old as that of the gasoline-powered automobile. Indeed, at one time many in the nascent automobile industry believed battery-powered engines would become the dominant technology. Before World War II, in both Europe and America, electric cars and trucks succeeded in meeting the needs of a wide range of consumers. As many as 30,000 electric cars and more than 10,000 electric trucks then plied American roads; European cities were busy with electrically propelled fire engines, taxis, delivery vans, buses, heavy trucks, and private cars.

Even so, popular memory and automotive historiography have left the impression that it was an inferior technology, and that view has remained stubbornly in place. In *The Electric Vehicle*, Gjis Mom, who teaches the history of technology at the Technical University of Eindhoven, challenges this view, arguing that at the beginning of the automobile age neither the internal

combustion engine nor the battery-powered vehicle enjoyed a clear advantage. He explores the technology and marketing/consumer-feedback relationship over four "generations" of electric-vehicle design, with separate chapters on privately owned passenger cars and commercial vehicles. He makes abundant comparisons among European countries and between Europe and America.

Professor Mom finds that the electric vehicle offered many advantages, among them greater reliability and control and less noise and pollution. He also argues that a nexus of factors – cultural (under-powered and less rugged, electric cars seems "feminine" at a time when most car buyers were men), structural (the shortcomings of battery technology at the time), and systemic (the infrastructural problems of changing large numbers of batteries) – ultimately gave an edge to the internal combustion engine. As a new generation of electric vehicles becomes a reality, *The Electric Vehicle* offers a long-overdue reassessment of the place of this technology in the history of street transportation.

Murmann, J.P. (2003). *Knowledge and competitive advantage: The coevolution of firms, technology, and national institutions*. NY: Cambridge University Press. ISBN: 0-521-81329-8, $60.00.

Entrepreneurs, managers, and policy makers must make decisions about a future that is inherently uncertain. Since the only rational guide for the future is the past, analysis of previous episodes in industrial development can shape informed decisions about what the future will hold. Historical scholarship that seeks to uncover systematically the causal processes transforming industries is thus of vital importance to the executives and managers shaping business policy today. With this in mind, John Peter Murmann, who is an Assistant Professor of Management and Organizations at the Kellogg School of Management at Northwestern University, compares the development of the synthetic dye industry in Great Britain, Germany, and the United States through the lens of evolutionary theory. The rise of this industry constitutes an important chapter in business, economic, and technological history because synthetic dyes, invented in 1856, were the first scientific discovery to quickly give rise to a new industry. Just as with contemporary high-tech industries, the synthetic dye business faced considerable uncertainty that led to many surprises for the agents involved. After the discovery of synthetic dyes, British firms led the industry for the first eight years, but German firms came to dominate the industry for decades; American firms, in contrast, played only a minor role in this important development. Murmann identifies differences in educational institutions and patent laws as the key reasons for German leadership in the industry. Successful firms developed strong ties to the centers of organic chemistry knowledge. As Murmann demonstrates, a complex coevolutionary process linking firms, technology, and national institutions resulted in very different degrees of industrial success among the dye firms in the three countries.

Nichols, F.D. & Griswold, R.E. (1978). *Thomas Jefferson, Landscape architect*. Charlottesville, VA: University of Virginia Press. ISBN: 0-8139-0899-X, $13.96.

Collaboration with the greatest botanists of his time, an instinctive humanitarianism, and a natural ingenuity in landscape design combined to make Thomas Jefferson a pioneer in American landscape architecture. Frederick D. Nichols and Ralph E. Griswold, in this close study of Jefferson's many notes, letters, and sketches, present a clear and detailed interpretation of his extraordinary accomplishments in the field.

Thomas Jefferson, Landscape Architect investigates the many influences on--and of--the Jeffersonian legacy in architecture. Jefferson's personality, friendships, and convictions, complemented by his extensive reading and travels, clearly influenced his architectural work. His fresh approach to incorporating foreign elements into domestic designs, his revolutionary approach to relating the house to the surrounding land, and his profound influences on the architectural character of the District of Columbia are just a few of Jefferson's contributions to the American landscape. Eighteenth- and nineteenth-century maps, plans, and drawings, as well as pictures of the species of trees that Jefferson used for his designs, generously illustrate the engaging narrative in *Thomas Jefferson, Landscape Architect*.

Oudshoorn, N. *The male pill: A biography of a technology in the making*. Durham, NC: Duke University Press. ISBN: 0-8223-3195-0, $21.95.

Why, forty years after the introduction of the contraceptive pill for women, is there still no equivalent for men? Nelly Oudshoorn seeks an answer in her new book *The Male Pill: A Biography of a Technology in the Making.*

Oudshoorn, who is a Professor of Gender and Technology at Twente University and an author of several books on gender and reproduction, explains why it is that, although the technical feasibility of male contraceptives was demonstrated as early as the late 1970s, there is, to date, no male pill. Ever since the idea of hormonal contraceptives for men was introduced, Oudshoorn stresses, scientists, feminists, journalists and pharmaceutical entrepreneurs have questioned whether men and women would even accept a new male contraceptive if one were available. *The Male Pill* provides a detailed examination of the cultural, policy, and scientific work around the male pill from the 1960s through the 1990s.

Oudshoorn emphasizes that the introduction of contraceptives for men depends to a great extent on changing ideas about reproductive responsibility. Initial interest in the male pill, she shows, came from outside the scientific community: from the governments of China and India, which were interested in population control, and from Western feminists, who wanted the responsibilities and health risks associated with contraception shared more equally between the sexes. She documents how in the 1970s, the World Health Organization took the lead in investigating male contraceptives by coordinating an unprecedented, worldwide research network.

Oudshoorn chronicles how the search for a male pill required significant reorganization of drug-testing standards and protocols and of the family-planning infrastructure – including founding special clinics for men, creating separate spaces for men within existing clinics, enrolling new professionals, and defining new categories of patients. *The Male Pill* is ultimately a story as much about the history of masculinity in the last decades of the twentieth century as it is about the development of safe and effective technologies.

Overly, Esq., M., & Kalyvas, Esq., James R. (2004). *Software agreements line by line: A detailed look at software agreements & how to change them to fit your needs*. Aspatore Books. ISBN: 1-58762-369-2, $49.95.

Today's business climate demands the ability to leverage essential technologies, as well as a heightened understanding of how the Software Agreement underlying such essential technologies may adversely affect your business. There has long been a disconnect between the interests of the end user and the objectives of the vendor in developing, drafting, and executing such agreements. *Software Agreements Line* by Line serves to bridge this gap. Taking a standard "vendor oriented" software agreement and breaking it down clause by clause, explaining the nuances of the language, and the business implications inherent therein, leading technology lawyers Michael Overly and James Kalvyas, both of whom are partners in the Los Angeles law firm Foley & Lardner specializing in technology, present a penetrating insight into the Software Agreement. The authors detail why such agreements should be modified, how to modify them, and offer practical solutions to promote your ability to successfully implement critical technologies in your business. A never before offered glimpse into the often daunting world of these highly technical agreements, *Software Agreements Line* by Line highlights the often overlooked, unnoticed and even hidden aspects of procuring and implementing business systems. The ability to understand and develop user-friendly software agreements offers great advantages for any company making investments in, and developing strategies around, software. This book will provide any reader the tools to become an informed user, a more strategic thinker, and above all, an empowered consumer.

Peskin, L.A. (2003). *Manufacturing revolution: The intellectual origins of early American industry*. Baltimore, MD: The Johns Hopkins University Press. ISBN: 0-8018-7324-x, $49.95.

"While much has been written about the industrial revolution", writes Lawrence A. Peskin, "we rarely read about industrial revolutionaries." This absence, he illustrates, reflects the preoccupation of both classical and Marxist economics with impersonal forces rather than individuals. In

Manufacturing Revolution Peskin, who is an assistant professor of history at Morgan State University, deviates from both dominant paradigms by closely examining the words and deeds of individual Americans who made things in their own shops, who met in small groups to promote industrialization, and who, on the local level, strove for economic independence.

In speeches, petitions, books, newspaper articles, club meetings, and coffeehouse conversations, they fervently discussed the need for large-scale American manufacturing a half-century before the Boston Associates built their first factory. Peskin shows how these economic pioneers launched a discourse that continued for decades, linking industrialization to the cause of independence and guiding the new nation along the path of economic ambition. Based upon extensive research in both manuscript and printed sources from the period between 1760 and 1830, this book will be of interest to historians of the early republic and economic historians as well as to students of technology, business and industry.

Porter, T. M. (2004). *Karl Pearson: The scientific life in a statistical age*. Princeton, NJ: Princeton University Press. ISBN: 0-691-11445-5, $35.00.

Karl Pearson, founder of modern statistics, came to this field by way of passionate early studies of philosophy and cultural history as well as ether physics and graphical geometry. His faith in science grew out of a deeply moral quest, reflected also in his socialism and his efforts to find a new basis for relations between men and women. This biography recounts Pearson's extraordinary intellectual adventure and sheds new light on the inner life of science.

Theodore Porter's intensely personal portrait of Pearson extends from religious crisis and sexual tensions to metaphysical and even mathematical anxieties. Pearson sought to reconcile reason with enthusiasm and to achieve the impersonal perspective of science without sacrificing complex individuality. Even as he longed to experience nature directly and intimately, he identified science with renunciation and positivistic detachment. Porter, who is Professor of History at UCLA, finds a turning point in Pearson's career, where his humanistic interests gave way to his statistical ones, in his *Grammar of Science* (1892), in which he attempted to establish scientific method as the moral educational basis for a refashioned culture. In this original and engaging book, a leading historian of modern science investigates the interior experience of one man's scientific life while placing it in a rich tapestry of social, political, and intellectual movements.

Rabinovitz, L. & Geil, A. (2004). *Memory bytes: History, technology, and digital culture*. Durham, NC: Duke University Press. ISBN: 0-8223-3241-8, $22.95.

Digital culture is often characterized as radically breaking with past technologies, practices, and ideologies, rather than as reflecting or incorporating them. *Memory Bytes* seeks to counter such ahistoricism, arguing for the need to understand digital culture – and its social, political, and ethical ramifications – in historical and philosophical context. Looking at a broad range of technologies, including photography, print and digital media, heat engines, stereographs, and medical imaging, the contributors present a number of different perspectives from which to reflect on the nature of media change. While foregrounding the challenges of drawing comparisons across varied media and eras, *Memory Bytes* explores how technologies have been integrated into society at different moments in time.

These essays from scholars in the social sciences and humanities cover topics related to science and medicine, politics and war, mass communication, philosophy, film, photography, and art. Whether describing how the cultural and legal conflicts over player piano rolls prefigured controversies over the intellectual property status of digital technologies such as MP3 files, comparing the experiences of watching QuickTime movies to Joseph Cornell's "boxed relic" sculptures of the 1930s and 1940s, or calling for a critical history of electricity from the Enlightenment to the present, *Memory Bytes* is a lively, enlightening examination of the interplay of technology and culture.

Riggs, K.E. (2004). *Granny @ work: Aging and new technology on the job in America*. New York: Routledge. ISBN: 0-415-96583-7, $19.75.

The advancing age of baby boomers, who are living longer and retiring later, has generated an unprecedented number of older workers in America. The Bureau of Labor Statistics predicts

that the population of workers 55 and over will practically double from 18 million in 2000 to more than 33 million by 2025.

In *Granny @ Work*, Karen Riggs- a renowned expert on aging and Associate Professor of Communication and Director of the School of Telecommunications at Ohio University – examines how this older workforce is coping with radical technological changes being introduced to the workplace – from e-mail to automation. Drawing on extensive interviews, she brings to light what employers, software engineers, and public policy makers seem to be thinking behind the scenes about the roles older adults might play in the workplace of the future – and asks whether those on the front lines of corporate life are actually looking out for the interests of a graying workforce. Riggs also challenges dominant beliefs about aging and technology as they are disseminated in popular culture, offering incisive analysis of a wide range of material from films focused on older characters such as *Cocoon* and *Space Cowboys* to specialty websites and magazines aimed at older workers.

Granny @ Work is an impassioned comment on aging, work, and technology in American culture. As Riggs challenges popular assumptions with surprising research – for example, people over the age of 60 sped more time on the Internet than people of any other age group – and trenchant cultural critique, she also forces us to confront the deeply entrenched ageism in today's technology-driven workplace.

Scarlett, M. (2004). *The great rip-off in American education: Undergrads underserved*. Amherst, NY: Prometheus Books. ISBN: 1-59102-031-x, $22.00.

Is a bachelor's degree from an American university really worth the ever-rising cost of obtaining one? According to former university president Dr. Mel Scarlett, who is currently president emeritus of Middle Tennessee State University, unless major changes are made to the American system of higher education, the disparity between the quality and the price of education is only going to get worse. The rise in tuition has substantially outpaced inflation over the last few decades, while the resources of larger "research" universities have shifted dramatically to feed the insatiable appetite of today's faculties, whose "publish or perish" culture has eclipsed any real concern for innovative teaching and sparking young minds to think independently. The undergraduate student is left in the cold: huge classes, an uninspiring lecture format, and perhaps worst of all, inexperienced teaching assistants whose English is often highly suspect. Scarlett spares no sacred cows when identifying the obstacles that prevent efforts to improve post-secondary education throughout the country. He offers a variety of "Radical Recommendations" to steer undergraduate education in a direction that will inspire and invigorate the learning experience. Be prepared to question everything you know about higher learning in America.

Schneier, B. (2003). *Beyond fear: Thinking sensibly about security in an uncertain world*. NY: Copernicus Books. ISBN: 0-387-02620-7, $25.00.

Searching kids and grandmas actually improves airport security, but arming pilots makes us all less secure; shopping with a credit card is just as secure as using it over the phone or by mail. These, and the dozens of other surprising insights in this book, will help you develop a keen sense of what today's most talked-about security measures can and cannot do.

Security is not mysterious, Bruce Schneier tells us, and contrary to popular belief, it is not hard. What is hard is separating the hype from what really matters. You already make security choices every day, from what side of the street you walk on to whether you park your car under a streetlight. You do it naturally. This book guides you, step by step, through the process of making all your security choices just as natural.

Schneier, a security expert for policy makers and business leaders, invites us all to move beyond fear and to start thinking sensibly about security. He tells us why security is much more than cameras, guards, and photo Ids, and why expensive gadgets and technological cure-alls often obscure the real security issues. Using anecdotes from history, science, sports, movies, and the evening news, *Beyond Fear* explains basic rules of thought and action that anyone can understand and, most important of all, anyone can use.

The benefits of Schneier's non-alarmist, common-sense approach to analyzing security will

be immediate. You'll have more confidence about the security decisions you make, and new insights into security decisions that others can make on your behalf. Whether your goal is to enhance security at home, at the office, and on the road, or to participate more knowledgeably and confidently in the current debates about security in our communities and the nation at large, this book will change the way you think about security for the rest of your life.

Shagena, J. L. (2004). *Who really invented the steamboat? Fulton's Clermont coup.* Amherst, NY: Humanity Books (Prometheus). ISBN 1-59102-206-1, $35.

Contrary to accounts found in school textbooks, and the claims of Robert Fulton himself, he did not invent the steamboat. This is the first work to chronicle the entire story of the steamboat and to place Fulton's contribution in perspective. Jack L. Shagena, a retired professional engineer, clarifies the nature of invention, examines various individuals who contributed to the steamboat's development, and identifies a more credible candidate for the title of its inventor. He also shows how the Fulton myth evolved.

Silberglitt, R.,Howell, D.R. & Sherry, L. (2003). *Research priorities of the Supporting Industries Program: Linking industrial R&D needs.* Arlington, VA: RAND Science and Technology. ISBN: 0-8330-3490-1, $20.00.

This documented briefing summarizes the results of an independent analysis of the vision statements and other documents relevant to the Industries of the Future initiative of the US Department of Energy (DOE) Industrial Technologies (IT) program. The RAND Corporation analyzed this information to identify links between the DOE/IT Supporting Industries program and other DOE/IT programs, which could potentially form the basis for alliances to facilitate the achievement of research goals.

Smith, J.E. (2004). *Biotechnology: Fourth edition*. Cambridge, UK: Cambridge University Press. ISBN: 0-521-54077-1, $26.99.

Biotechnology will undoubtedly be the major technology of the twenty-first century. It concerns the practical application of biological organisms or their various components to the benefit of humankind, and spans a multitude of modern and traditional industries. The rise of genetic engineering, genomics, proteomics, and the creation of transgenic crops and animals has revolutionized activities as varied as brewing beer and the treatment of sewage and wastewater, to drug development and agriculture.

In this expanded fourth edition of his popular textbook, Emeritus Professor of Applied Microbiology at the University of Strathclyde in Glasgow, John Smith once again demystifies biotechnology, and especially genetic manipulation, clearly and accessibly explaining the history, techniques and applications of modern biotechnology for students and the general reader. All aspects of biotechnology are covered and a positive stance is taken concerning the potential benefits to human society. In this edition, greater emphasis is given to the public perception of biotechnology and the ethical and safety questions raised.

Spitz, P.H. (2003). *The chemical industry at the millennium: Maturity, restructuring, and globalization*. Philadelphia, PA: Chemical Heritage Press. ISBN: 0-941901-34-3, $45.00.

The global chemistry industry is big business and growing every year. But impressive growth has not recently impressed investors, and increasingly both individuals and money managers have turned to other areas of the economy for better returns. A 4 percent growth rate throughout the 1990s was not enough to keep US chemical companies from seeking opportunities in more rapidly growing regions with low-cost feedstock, and the US trade balance in chemicals turned downward in the late nineties; by 2001 chemical imports exceeded exports.

Why has an industry that provides so many of the essentials of modern life been so severely challenged? In The Chemical Industry at the Millennium, Peter Spitz, who is a renowned expert on the evolution of the global chemical industry, and a team of industry experts look at this complex and fascinating industry. Concentrating on basic and specialty chemicals, chapter authors examine many of the trends and market factors that have affected the chemical industry in the

recent past. The book offers an insider's view of the restructuring and reengineering crazes and the improvements and roadblocks offered by information technology and the Internet. Other factors that came into play include the impact of environmental regulations and globalization and the financial community's demand for greater shareholder value. The Chemical Industry at the Millennium is a must read for industry professionals and anyone else interested in the changes and challenges facing a great and essential industry.

Squier, S.M. (2003). *Communities of the air: Radio century, radio culture*. Durham, NC: Duke University Press. ISBN: 0-8223-3095-4, $21.95 (Paperback).

A pioneering analysis of radio as both a cultural and material production, *Communities of the Air* explores radio's powerful role in shaping Anglo-American culture and society since the early twentieth century. Scholars and radio writers, producers, and critics look at the many ways radio generates multiple communities over the air – from elite to popular, dominant to resistant, canonical to transgressive.

Drawing on the perspectives on literary and cultural studies, science studies and feminist theory, radio history, and the new field of radio studies, these essays consider the development of radio as technology: how it was modeled on the telephone, early conflicts between for-profit and public uses of radio, and amateur radio (HAMS), local programming, and low-power radio. Some pieces discuss how radio gives voice to different cultural groups, focusing on the BBC and poetry programming in the West Indies, black radio, the history of alternative radio since the 1970s, and science and contemporary arts programming. Others look at radio's influence on gender (and gender's influence on radio) through examinations of Queen Elizabeth's broadcasts, Gracie Allen's comedy, and programming geared toward women. Together the contributors demonstrate how attention to the variety of ways radio is used and understood reveals the dynamic emergence and transformation of communities within the larger society.

Steiner, G. (2004). *Descartes as a moral thinker: Christianity, technology, and Nihilism*. Amherst, NY: Humanity Books. ISBN: 1-59102-212-6, $59.00

Although commentary on Descartes is extensive, the importance of morality in his thought has been all but overlooked in contemporary English-language scholarship. Considered to be the first modern philosopher, Descartes is often interpreted as a wholly secular thinker who acknowledged no authority above the human will. In this important reassessment of the great French philosopher, Gary Steiner, who is an associate professor of philosophy at Bucknell University, shows the influence of Christian thought on the moral foundations of Descartes' philosophy.

Steiner provides a close analysis of all of Descartes' texts and correspondence bearing on morality. By placing his work in historical context, Steiner demonstrates Descartes' indebtedness not only to Galileo and Bacon in developing his conception of autonomous human reason, but also to Augustine and Aquinas in conceptualizing the human condition and the role of belief in God. Providing a detailed survey of German, French, and English scholarship on Descartes, Steiner concludes with an in-depth examination of contemporary debates about secularization, nihilism, and modernity in such thinkers as Nietzsche, Heidegger, Hans Blumenberg, and Karl Lowith. Steiner shows how Descartes' own ambivalence about the relation between faith and reason can shed light on contemporary controversies regarding what Blumenberg calls "the legitimacy of the modern age."

Sterne, J. (2003). *The audible past: Cultural origins of sound reproduction*. Durham, NC: Duke University Press. ISBN: 0-8223-3013-x, $22.95 (Paperback).

We take our noisy world, full of artificial sounds, for granted today. Jonathan Sterne, who teaches in the Department of Communication and the Program for Cultural Studies at the University of Pittsburgh and writes about media, technology and the politics of culture, takes us back to the cultural origins of sounds reproduction. He describes a distinctive sound culture that gave birth to the sound recording and transmission devices so ubiquitous in modern life. With an ear for the unexpected, scholar and musician Sterne uses the technological and cultural precursors of telephony, phonography, and radio as an entry point into a history of sound in its own right.

Blending cultural studies and the history of communication technology, Sterne follows modern sound technologies back through a historical labyrinth. Along the way, he encounters capitalists and inventors, musicians and philosophers, embalmers and grave robbers, doctors and patients, deaf children and their teachers, professionals and hobbyists, folklorists and tribal singers. *The Audible Past* tracks the connections between the history of sound and the defining features of modernity: from developments in medicine, physics, and philosophy to the tumultuous shifts of industrial capitalism, colonialism, urbanization, modern technology, and the rise of a new middle class.

A provocative history of sound, *The Audible Past* asserts that sound is not a natural category and that what we hear and how we hear it has its cultural origins in the nineteenth and twentieth centuries. With its truly interdisciplinary approach, the book will fascinate those interested in the history of technology, cultural studies, communication, and music.

Stoltzenberg, D. (2004). *Fritz Haber: Chemist, Nobel Laureate, German, Jew*. Philadelphia, PA: Chemical Heritage Press. ISBN: 0-941901-24-6, $40.00.

The long-awaited biography of Fritz Haber, now abridged by the author and translated into English, illuminates the life of one of the most gifted yet controversial figures of the twentieth century.

Haber, a brilliant physical chemist, carried out pioneering research in electrochemistry and thermodynamics and won the Nobel Prize for his synthesis of ammonia, a process essential for synthetic fertilizer – and for the explosives Germany needed in World War I.

An ardent patriot, Haber also developed chemical weapons. Believing them to be no worse than other types of warfare, he directed the first true gas attack in military history from the front lines in Flanders. His nationalism also spurred his failed attempt to extract gold from seawater, in hopes of paying off Germany's huge war reparations.

Yet Haber, a Jew by birth, was exiled from his homeland in 1933 by the Nazi party. He died the following year, never knowing the full dire effects of his work, as Zyklon B, a gas studied in his institute around 1920, was used to murder prisoners in concentration camps, including members of Haber's own family.

With the help of previously unpublished documents and sources, Dietrich Stoltzenberg explores Haber's personal life, including the breakdown of his two marriages, his efforts to develop industrial and political support for scientific study in Germany, his directorship of the Kaiser Wilhelm (now Max Planck) Institute, his ethical struggles in times of war, and much more. A detailed and fascinating portrait of a brilliant scientist who is both revered and reviled, this book is a must read for historians and scientists, as well as those with an interest in the history of Germany in the early twentieth century.

Sturken, M., Thomas, D. & Ball-Rokeach, S.J. (2004). *Technological visions: the hopes and fears that shape new technologies*. Philadelphia, PA: Temple University Press. ISBN: 1-59213-226-X, $23.95.

For as long as people have developed new technologies, there has been a debate over the purposes, shape, and potential for their use. A range of contributors, including Sherry Turkle, Lynn Spigel, John Perry Barlow, Langdon Winner, David Nye, and Lord Asa Briggs, discuss the visions that have shaped "new" technologies and the cultural implications of technological adaptation. Focusing on issues such as the nature of prediction, community, citizenship, consumption, and the nation, as well as the metaphors that have shaped public debates about technology, the authors examine innovations past and present, from the telegraph and the portable television to the Internet, to better understand how our visions and imagination have shaped the meaning and use of technology.

Van Dulken, S. (2004). *American inventions: A history of curious, extraordinary, & just plain useful patents*. Washington Square, NY: New York University Press. ISBN: 0-8147-8813-0, $26.95.

An American, Thomas Alva Edison, invented the light bulb, but who invented the pregnancy test? Or the air bag? Who patented the first computer? Stephen van Dulken, an expert curator in the Patents Information Services of the British Library, examines the way inventions and patents such as these have helped to create the American Dream.

Between 1911 and 1999, the number of registered US patents rose from 1 million to 6 million. Showcasing dozens of those original patent drawing from the US Patent and Trademark Office, *American Inventions* shows how trends in the history of the United States are reflected in the patent records. For example, the invention of the Frisbee dates back to 1920 when a Yale University student recalled throwing around the lids from the pie cans of the nearby Frisbie Baking Company, but it was not until 1948 that Fred Morrison and Warren Francioni capitalized on Americans' new-found fascination with flying saucers by applying for a patent on a flying plastic disk. Van Dulken surveys the inventions and patents of the workplace, the home, the kitchen, the open road, and the beauty parlor, to name a few, to find the compelling stories and eureka moments in American history. From bobby pins to in-line skates, from the jukebox to the fax machine, *American Inventions* is a captivating catalog of the famous and not-so-famous contraptions that have shaped the American way of life.

Vicente, K. (2004). *The human factor: Revolutionizing the way people live with technology*. New York, NY: Routledge. ISBN: 0-415-97064-4, $27.95.

Technological innovation is progressing at such a rapid pace that we have fallen behind in our ability to manage it. Our world is filled with objects that invite human error, from VCRs to stoves. But the negative impact of technology on contemporary society goes well beyond the frustrations caused by these everyday items, often affecting areas as significant as hospital administration, airplane cockpits, and nuclear power plants. Problems – some potentially catastrophic- continuously arise when designs are developed without human nature in mind. Our reaction to this dilemma has been to create more sophisticated and ultimately confusing technology, perpetuating a vicious cycle as we struggle to keep up.

Now, in *The Human Factor*, McLean Award winning author and former Hunsaker Distinguished Visiting Professor of Aeronautics and Astronautics at MIT Kim Vicente makes vividly clear how people can bridge the widening gap between human beings and technology. He investigates every level of human activity – from simple matters such as hand-eye coordination to complex human system such as government regulatory agencies, and why businesses would benefit from making consumer goods easier to use. He shows readers why we all have a vital stake in reforming the aviation industry, the health industry, and the way we live day-to-day with technology.

Our traditional ways of thinking have ignored – and virtually made invisible – the relationship between people and technology. In *The Human Factor*, Vicente defines his theory of mechanistic versus humanistic schools of thought and how these two disparate ideologies – essentially technological tunnel vision versus the purely human/emotional mode of thinking – would be best served if they were more complimentary, or, as he defines it, more "human-tech."

With "human-tech," the author seeks to reconcile two heretofore incompatible elements and provide examples and suggestions of how ever-advancing technology can better serve, rather than rule, mankind. Vicente discusses everything from the "human-tech" successes of such items as the Reach toothbrush and the Fender Stratocaster electric guitar to the "human-tech" shortcomings of the medical and nuclear power industries. Citing historical events such as the disaster at Chernobyl and the Space Shuttle *Challenger* accident, among others, Professor Vicente demonstrates how this lack of "human-tech" thinking helped lead to these most likely preventable calamities.

Human beings are capable of many remarkable things, but if we become alienated from technology, our full capacities won't be realized. This incessantly readable and ultimately hopeful, groundbreaking work offers solutions that have enormous implications for human life. As accessible and entertaining as it is provocative, *The Human Factor* is certain to create vigorous public debate.

The 2004 Paul T. Hiser Exemplary Publication Award Recipients

Robert E. Wenig

"Leadership Knowledge and Skill: An Enabler for Success as a Technology Education Teacher–Leader"

The Board of Editors of The Journal of Technology Studies and the Board of Directors are pleased to announce the recipients of the Paul T. Hiser Exemplary Publication Award for Volume XXX, 2004.

The Board of Directors established this award for deserving scholars. In recognition for his exemplary service to the profession and to the honorary as a Trustee and Director, the award bears Dr. Hiser's name. It is given to the author or authors of articles judged to be the best of those published each year in this journal.

Selection Process

Each member of the Editorial Board recommends the manuscript that he or she considers the best of those reviewed during the year. The editor forwards copies of nominated manuscripts to the members of the board for their evaluation against the criteria.

A majority vote of the editors is required for the award to be made. The honor society's Board of Directors renders final approval of the process and the award.

Criteria

1. The subject matter of the manuscript must be clearly in the domain of one or more of the professions in technology.

2. The article should be exemplary in one or more of the following ways:
   - Ground-breaking philosophical thought.
   - Historical consequence in that it contains significant lessons for the present and the future.
   - Innovative research methodology and design.
   - Trends or issues that currently influence the field or are likely to affect it.
   - Unique yet probable solutions to current or future problems.

A $300 award recognizes the recipient(s) for the year and is presented during an Epsilon Pi Tau program at an annual professional association conference.

GUIDELINES FOR
The Journal of Technology Studies

A refereed publication of Epsilon Pi Tau the international honor society for professions in technology.

The Journal of Technology Studies (JOTS) is the flagship, peer-reviewed journal of Epsilon Pi Tau, an international honor society for technology professions. Two print issues per year are mailed to all members of the society as well as to academic and general libraries around the globe. These printed issues, plus additional issues available only in electronic format as well as past issues, are available free on-line at scholar.lib.vt.edu/ejournals/jots.

SUBJECT FOCUS

The JOTS welcomes *original* manuscripts from scholars worldwide focused on the depth and breadth of technology as practiced and understood past, present, and future. Epsilon Pi Tau, as perhaps the most comprehensive honor society among technology professions, seeks to provide upto-date and insightful information to its increasingly diverse membership as well as the broader public. Authors need not be members of the society in order to submit manuscripts for consideration. Contributions from both academics and practitioners are equally welcome.

A general guide to the breadth of topics of potential interest to our readers can be gained by consideration of the 17 subclasses within "Technology" of the classification scheme of the Library of Congress, USA <lcweb.loc.gov.catdir/cpso/lcco/lcco_t.pdf>. This includes engineering and allied disciplines, informatics in its many manifestations, industrial technology, and education in and about technology. Authors are strongly urged to peruse this list as they consider developing articles for journal consideration. In addition, JOTS is interested in manuscripts that provide:

- brief biographical portraits of leaders in technology that highlight the difference these individuals made in distinct fields of technology or its wider appreciation within society,
- thoughtful reflections about technology practice,
- insights about personal transitions in technology from formal education to the work environment or vice versa,
- history, philosophy, sociology, economics, and anthropology of technology,
- technology within society and its relationship to other disciplines,
- technology policy at local, national, and international levels,
- comparative studies of technology development, implementation, and/or education,
- industrial research and development,
- new and emerging technologies and technology's role in shaping the future.

Within this immense diversity of technology, its applications and import, authors must communicate clearly, concisely, informatively, and only semi-technically to readers from a diverse set of backgrounds. Authors may assume some technical background on the part of the reader but not in-depth knowledge of the particular technology that is the focus of the article. Highly technical articles on any field of technology are not within the purview of the journal. Articles whose subject focus has been extensively explored in prior issues of the journal are only of potential interest if they: 1) open up entirely new vistas on the topic, 2) provide significant new information or data that overturns or modifies prior conceptions, or 3) engage substantially one or more previously published articles in a debate that is likely to interest and inform readers. Syntheses of developments within a given field of technology are welcome as are metanalyses of research regarding a particular technology, its applications, or the process of technical education and/or skill acquisition. Research studies should employ methodological procedures appropriate to the problem being addressed and must evince suitable design, execution, analysis, and conclusions. Surveys, for example, that exhibit any or all of the following characteristics are of no interest to the journal: 1) insufficient awareness of prior research on this topic, 2) insufficient sample size, 3) improper survey design, 4) inappropriate survey administration, 5) high mortality, 6) inadequate statistical analysis, and/or 7) conclusions not supported by either the data or the research design employed. The journal is neutral in regards to qualitative, quantitative, or mixed method approaches to research but insists on research quality.

GUIDELINES FOR The Journal of Technology Studies (Continued)

GUIDELINES FOR SUBMISSION

Articles must conform to the most current edition of the Publication Manual of the American Psychological Association. All articles must be original, represent work of the named authors, not be under consideration elsewhere, and not be published elsewhere in English or any other language. Electronic submissions in either rich-text format or Microsoft Word formats are encouraged, although submission of three printed copies and a diskette containing the article are also permissible. E-mail submissions should be sent to the editor, Dr. Dennis Cheek, at jots@bgnet.bgsu.edu. Paper submissions should be mailed to:

Editor, Journal of Technology Studies
Epsilon Pi Tau, Technology Building
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Manuscripts should be no more that 25 pages, double spaced, including references. Typescript should be *Times New Roman* or a close approximation of font and 12 point. Only manuscripts in the English language will be accepted and they should conform to American usage. Figures, tables, photographs, and artwork must be of good quality and conform to APA form and style.

REVIEW PROCESS

Articles deemed worthy by the editor for consideration by Authors who submit an article that does not merit review by the editorial board are informed within approximately two weeks of receipt of the article so that they may explore other publishing venues. A rejection may be based solely on the content focus of the article and not its intrinsic merit, particularly where the topic has been extensively explored in prior JOTS articles. Articles that exhibit extensive problems in expression, grammar, and spelling are summarily rejected. Authors of articles that have been peer-reviewed are informed within about three months from the date of submission of the article. Anonymous comments of reviewers are provided to authors that are invited to submit a revised article for either publication or a second round of review. The editor does not automatically provide reviewer comments to authors whose articles have been rejected via the peer review process but makes a judgement based on whether the feedback might prove beneficial to the authors as they pursue other publishing opportunities.

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Authors whose articles have been accepted, will have their final products published in the on-line version of the journal. Selected articles from the on-line edition of the journal may also appear in two print issues that are issued per calendar year. All authors will receive a pdf version of their published article and co-retain rights to that article along with Epsilon Pi Tau. The editor will supply when requested information about an accepted article that has not yet appeared in print for faculty undergoing tenure review.