IDENTIFICATION OF COMPUTER HARDWARE AND SOFTWARE USED BY THE PRINTING AND PUBLISHING INDUSTRY

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Identification of computer hardware and software used by the printing and publishing industry.

As the printing and publishing industry continues to use multiple computer hardware and software platforms to support the different facets of their business, it can be difficult to say what computer hardware and software is the industry standard. Knowing what computer hardware and software is very important for a graphic communications instructor when starting or updating a program so the students that go through the program have experience on similar computer hardware and software and have the transferable skills to go on with their education in graphic communications or acquire a job in the printing and publishing industry.

The survey for this research included demographic questions, questions about what computer hardware was being used and the number of each, what computer
operating systems were being used, what drawing software, image editing/manipulation software and page layout software, the amount of files sent to the printer using a digital format and the amount of files being sent to press by computer-to-plate technology.

The research found that Apple had a slight edge in the percentage of computers running their operating system, with 53.64% of all computers running their operating systems. The research also found that the following were industry standard or the most used software: drawing — Adobe Illustrator, image editing/manipulation — Adobe Photoshop and page layout — QuarkXpress. The research also found that most companies are receiving their files from the customer in a digital format compared to the traditional method of paper or film copies. Last it was found that computer-to-plate technology is starting to be used by larger companies but not as regular with smaller sized companies.
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Chapter One

Introduction

Educators are faced with many questions when it comes to changing or updating their curriculum and the equipment that is used to support that curriculum. With the increasing rate at which new technology is developed it is hard for any teacher to keep up to date with many of the technological devices they may have in their classroom or technical devices that educators would like to include in their classroom. One of the most common pieces of technology in a classroom or lab is the computer. Computers in schools are used for many different tasks and purposes. These tasks can include attendance taking, e-mail, record keeping and the use of the computer as a learning tool for students. Moltenda and Sullivan (2002) discuss that the use of computers by teachers in the classroom is “highly correlated with the level of technology support at the building level.” The computers today have made a tremendous stride from the first computer that was built in the United States. The first computer built in the United States was in the late 1940’s (Ifrah, 2001). It was designed for an aviation company so the computer was only capable of completing one type of task (Ifrah).

Today’s computers have developed immensely from being a machine that took up a good-sized room, to a computer that can be carried around in the palm of your hand or smaller. This advancement has allowed for the computer to be integrated into education more and more. Larry Cuban (2001) talks about the push to include the “new technologies” into schools in the early 1980’s. The computer was one of these “new technologies”. From this point on, computers have become increasingly visible in the educational classroom. Some school districts have created partnerships with computer
manufacturing companies to provide computers for teachers, students or both. One example is in the Houston Independent School District where every teacher will have a laptop computer so they can complete computer work at home ("Inside: Technology", 2002).

It is no surprise that there are people who disagree with the amount of computers in schools. Cuban (2001) wrote a book titled Oversold and Underused: Computers in the Classroom, which discusses the amount of computers in schools that are underused. With any topic you will always have proponents and opponents of the subject.

As stated at the beginning of this chapter, schools use computers in many different ways. One area in education where computers have definitely become the norm is in Technology Education and specifically in the area of Graphic Communications or Graphic Arts. The computer is used as a tool to help students work through the graphic design process, layout multi-page documents and learn about different types of files created by different software programs and how these files can be transferred from one place to another. By including current computer hardware and software in the classroom students can be taught using the hands-on learning approach. Using hands-on learning has many benefits. Bowden (2002) states, “Hands-on learning activities not only improve memory and understanding they also make abstract concepts real and relevant.” Through hands-on learning, students gain valuable skills that can be transferred to future jobs in the printing industry. These transferable skills are very important for any student looking at continuing his or her education in Graphic Communications. Besides using the computer as a tool to help students learn about the different topics listed above, the
computer is also an excellent example of how technology has changed the world we live in and specifically the way the graphic communications industry operates.

With the computer we now have desktop publishing, which is defined as the "use of [the] personal computer as front end to [the] printer" (Xerox, 1991, p. 23). The computer has revolutionized the process of creating the final product that is sent off to the company that is responsible for printing the document. The process of submitting the final project to the printer has also been changed by the use of the computer. Previously the customer would submit the project on paper and a negative and plate had to be made by the printer. This is called conventional prepress. Now with the computer, customers can submit files to the printer in either application files or PDF (portable document files), which can then be turned directly into plates. This process is known as digital prepress. This allows the printer to make any needed changes to the document before printing and allows them to create plates directly from the computer, which is known as computer to plate technology (CTP).

The wide array of computers available to the world today can make it very difficult to decide what computer to purchase for use in education. Molenda and Sullivan (2002) state, "Schools, like colleges and universities, are struggling with the challenge of acquiring and maintaining an information technology infrastructure." There are updates to both the computer hardware and software on a regular basis. These updates can become very expensive for a school district if they choose to keep their computer hardware and/or software up to date. Before anyone looks into purchasing a computer he/she must make a distinction between two terms. The first term is computer hardware. Computer hardware is defined as the "physical equipment that makes up [a] computer
system" (Xerox, 1991, P.38). The second term is computer software. Computer software is defined as the "... program contained on user loadable media which govern[s] the system operation and make[s] the hardware run" (Xerox, 1991, P. 83). When buying a computer one must look at what computer hardware and software comes with the computer they are looking at purchasing.

When a Graphic Communications instructor is looking at purchasing a computer there are many different questions he or she must ask. These questions range from the brand of computer to the software available for that computer. The first question that the instructor must ask is Macintosh or Windows? These are the two prevalent operating systems on the market for personal computers. Each operating system has its positives and its negatives. Windows machines are the most prevalent machines used in homes today. However Macintosh "...rules in the production departments and graphics businesses" (Hall, 2001). Most schools will choose to only use one operating system in their buildings or district to ease in the technical support of their computers. This is another factor that Graphic Communications instructors face when choosing what operating system they would like to purchase. Both of these operating systems have been around for at least 15 years. Macintosh computers were released for the first time in 1984 and windows based machines came after ("Through the years", 2001).

The second question a Graphic Communications instructor must ask is what software will need to be purchased? There are many different vendors in the software industry who are battling for a piece of the software sales for the year. Walsh (1997) discusses the competition between two software companies prevalent in the graphics industry; these companies are Adobe and Quark. With all the different software available
and the different versions of software, the decision on which version of the software to purchase is not always easy. It is not always necessary or economical to buy the newest version of software, but it may be more economical to buy an older version of the software and upgrade later from that version (Litt, n.d.). Software can be written for a single purpose or be a multi-functional software. In Graphic Communications three main categories of software are needed. These categories include a drawing program, a photo editing/image manipulation program and a page-layout program.

Each one of these categories offers a variety of software that can be run on a Macintosh or Windows platform or can be purchased for both platforms. The first category, drawing programs, may include, but is not limited to, any of the following examples of software: Claris MacDraw, Adobe Illustrator, Claris CAD, CorelDraw, Micrografx Designer and AutoCad (Sosinsky, 1991). The second category of software, photo editing/image manipulation programs, can include, but is not limited to, any of the examples: AldusSnapshot, Adobe Photoshop, Digital Darkroom, ColorStudio, Publishers Paintbrush, Photostyler and Picture Publisher (Sosinsky). The third and final category of software, page-layout programs, can include, but is not limited to, any of the following examples: PageMaker, DesignStudio, FrameMaker, GEM Desktop Publisher, Publish It! and QuarkXPress (Sosinsky).

As one can see there are many decisions that must be made about choosing computer hardware and software for education and specifically educating students about Graphic Communications. There are many articles available to help someone buy a computer, but most are written for the home personal computer (PC) buyer instead of education. A quick search of any database will produce many articles that supply tips on
purchasing different computers and software. One such article from McKean titled *Nine Timeless Tips for Tech Buyers* has some very thoughtful ideas about buying PCs (2002). Kennedy notes in his article “the hard part is figuring out just what to get” (2001).

Kennedy (2001) also comments on relying on the manufacturer for information, “Manufacturers have a vested interest in selling you their newest, most expensive models, with features you might never need.” As one can see there are many items to consider when a Graphic Communications instructor is looking at upgrading or purchasing new computer hardware and/or software for their Graphic Communications computer lab.

Graphic Communications instructors must make this decision on a regular basis as technology is changing at such a rapid rate along with advances in computer technology. By looking at what the Graphic Communications and Printing industry is using for computer hardware and software, the Graphic Communications instructor can narrow down his or her choices of what computer hardware and software to purchase.

**Statement of the Problem**

The problem that this study has addressed is that, given the need to upgrade and purchase new hardware and software, Graphic Communications instructors don’t know what computer hardware and software is currently in use by the printing and publishing industry.

**Purpose of the Study**

The purpose of this study was to identify the current computer hardware and software including version, used by the Graphic Communications and Printing industry in the State of Wisconsin. This research can be used to support Graphic Communications
instructors in their decisions regarding what computer hardware and software that is to be purchased.

Research Questions

1. What computer operating systems, including versions, are being used by businesses in the Graphic Communications and Printing industry in the State of Wisconsin?

2. What drawing programs are being used by businesses in the Graphic Communications and Printing industry in Wisconsin?

3. What photo editing/image manipulation programs are being used by businesses in the Graphic Communications and Printing industry in Wisconsin?

4. What page-layout programs are being used by businesses in the Graphic Communications and Printing industry in Wisconsin?

5. What percentages of printing jobs are submitted in conventional format (layouts, films, or plates) vs. digital format (computer files)?

6. What percentage of computer files are submitted in application files (layout applications) vs. PDF files or other software?

7. What are the differences in computer hardware and software used, based on demographics?

Significance of the Study

This study is important for several reasons:

1. The data collected from this study can be used by Graphic Communications instructors to help in recommending what computer hardware and operating
system, including version, would be the best for their school’s Graphic Communications program.

2. The data collected from this study can be used by Graphic Communications instructors to help in recommending what computer software, including version, should be purchased or upgraded in the following categories: drawing software, photo editing/image manipulation software and page-layout software.

3. To help Graphic Communications instructors facilitate the development of a timeline for computer hardware and software upgrades to be purchased.

4. To help Graphic Communications instructors justify budgeting for faculty training on the upgraded or new computer hardware and software.

5. Businesses dealing with Graphic Communications and the Printing industry may use this study to upgrade or replace hardware and software for their company.

Limitations of the Study

The limitations of this study are as follows:

1. The participants in this survey were limited to a sample of businesses that are members of Printing Industries of Wisconsin and are based in the State of Wisconsin.

2. The results from this study are limited to Wisconsin.

3. The researcher developed the survey instrument.
4. The participants in this study were selected from a membership list provided by Printing Industries of Wisconsin of which some members may not deal with the press area of printing and publishing.

Assumptions of the Study

1. The researcher assumes that all companies related to the Graphic Communications and Printing industry are using computers.

2. The researcher assumes that all respondents of the survey answered in a truthful, honest and timely manner.

3. The researcher assumes that all targeted participants received their survey.

4. The researcher assumes that those surveys sent to participants that were no longer employed by that company or were sent to the incorrect person at the company to answer the survey were forwarded to an appropriate individual.

5. The researcher assumes that all participants in the study were familiar with terminology and brand names used in the survey.

Definition of Terms


2. Adobe Photoshop – Image Manipulation – Software that allows the user to electronically scan, edit and enhance images” (Morril, 2000)

3. Drawing Program – “Think of a draw program for object graphics as being composed of a set of tools similar to those you find in a drafting kit: pencils, pens, rulers, French curves, compasses, and the like” (Sosinsky, 1991, p. 240)
4. Image Manipulation Program — "A program that allows the user to edit scanned images such as contone art and photographs." (McAllister, 1997)

5. Operating System — "The software (and in some cases firmware) that provides the environment within which all other software and its user operates." (Campbell, 2000, p.118)


7. Technology Support — "...entails facilities, presence of support staff, personal help and guidance, professional development, and professional incentives" (Molenda, Sullivan, 2002)

8. QuarkXPress — Page-Layout Program — Provides all the tools to create, design, and deliver high-impact publications in both print and electronic media." (What is QuarkXPress?, n.d.)

9. Adobe PageMaker 7.0 — Page Layout Program — "ideal page layout program for educators and students who want to create high-quality publications such as brochures and newsletters." (Adobe in Education: Print Products, n.d.)

Methodology

This is a quantitative research study. The researcher sent out a survey to selected participants from a membership list provided by Printing Industries of Wisconsin to establish what computer hardware and software is currently being used and what percentage of files submitted are conventionally versus digitally to the printer. The next chapter will give background information on computers in schools, different computer
hardware and corresponding operating systems and software used in the Graphic Communications industry.
Chapter Two

Introduction

Chapter two will discuss the following topics that have been found in literature.

They are:

1. How computers have changed.
2. The use of computers in schools.
3. Computer hardware and software used by the printing and publishing industry.
4. Choosing computer hardware and software for a high school Graphic Communications program.

By looking back at where the computer came from one can understand the enormous changes that the computer industry has gone through since it's beginning.

Computers—Ever Changing Since their Beginning

In 1946 the “first large scale, general purpose electronic digital computer, the ENIAC, is created at the University of Pennsylvania. The ENIAC weighed 30 tons and contained 18,000 vacuum tubes” (Timeline: 50 years of computing, 1997). From this point on the computer has become an ever-changing technological innovation. The first computer was obviously not made for any home use but as technology in the area of computers advanced the notion that the general public could own a computer would come about. “The arrival of the transistor and the miniaturized circuit in the 1950s made it possible to reduce a room-size computer to a silicon chip the size of a pea…” (Horowitz & Labi, 1997)

“One of the first personal computers ever made available to the public was the $400 MITS Altair…” (Thurber, 1995). Being one of the first personal computers it
“...had few options and amenities: memory was 256 bytes, there was no permanent storage and it came without a keyboard” (Thurber). The first computers available to the public were obviously very slow and crude compared to today's standards. When a person purchased the above mentioned MITS Altair you also had to build it by yourself because the Altair was offered as a kit for the consumer to build (Thurber). Once the personal computer was revealed to the public, the personal computer took off in both the home/personal use and the business world.

As computers became more and more accessible to society, the prevalence of the computer around the world started to grow. Many home computers started like the Altair, but each computer also needed an operating system. The first operating system that was developed for microcomputers was developed by Gary Kildall in 1974 and was named CP/M (Metz, 2001). Other companies and developers were also in the process of developing their own operating systems and software to compete for part of the market share. A company with the title Microsoft, was created by Paul Allen and Bill Gates in 1975 (Metz). With the advent of the company Microsoft, which has become a giant in today's computer industry, the advent of Apple Computer was right around the corner.

Steve Jobs and Steve Wozniak started Apple computer on April 1, 1976 (Timeline: 50 years of computing, 1997). Apple Computer's first product was a computer circuit board called the Apple 1, which had no keyboard, case and power supply (Metz).

Apple brought its first fully assembled computer to the market, the Apple II, in 1977 at a cost of $1,298 at the time but required the user to use their own TVs as monitors and for data storage, the user had to use their own audiotape cassette recorder (Metz, 2001). Besides Apple releasing computers the advent of the portable computer was taking
shape during this time period. A company called Osborne Computer released the Osborne 1, which was the first portable computer at a cost of $1,795 and weighing in at 23 pounds (Metz).

As previously stated, all computers need an operating system to run other software on that computer. In 1981 Microsoft released the operating system known as MS-DOS for the IBM PC (Timeline: 50 years of computing, 1997). Other companies looked to make a profit off the fast-growing computer market. The first company to take advantage of making a profit off making a clone (an exact copy) of the IBM PC was Columbia Data Products, which released the MPC in 1982 (Timeline: 50 years of computing). Another future competitor in the PC market was the Compaq Computer Corporation, which started in February 1982 by Rod Canion, Jim Harris, and Bill Murto (Metz, 2001).

During this time Apple Computer continued to release new products onto the market. The next computer that Apple introduced was the Lisa, which was one of the first computers to have a graphical user interface, at a cost of $9,995 at that time (Metz, 2001).

The computer itself hit a milestone in history during 1983 when Time Magazine selected the personal computer as the “Machine of the Year” (Timeline: 50 years of computing, 1997). “The cover story states that Americans’ passion for computers ‘is partly fading, partly a sense of how life could be made better, partly a gigantic sales campaign.’ A poll reveals that 67% of respondents believe the technology will improve the quality of their children’s education.” (Timeline: 50 years of computing). As one can see the general public felt that the computer would enhance future generations including their children’s education.
After the computer was named the "Machine of the Year" Apple continued its path towards producing computers for the public and making them aware of the computers that they were selling. In January of 1984, Apple ran a commercial during Super Bowl XVIII and two days later introduced the first Macintosh computer that came with a 3.5" floppy-disk drive and a built-in 9" screen for a price of $2,495 (Metz, 2001). Along with the growth of the Macintosh computer the software companies were also working to sell new and better products in many different areas. One such company was Aldus Corporation, who released PageMaker in 1985, which was a desktop publishing or page layout program (Metz). From this point on the growth of computer hardware and software continues to grow including the area of graphic design and page layout.

As this was taking place, Apple computers continued its growth and worked toward gaining more ground in the education market for computers. In 1986, "Apple announces it will build a network of specialty dealers to service the education market. U.S. schools are given the opportunity to trade in old Apple, IBM, Tandy and Commodore PCs for credits towards the purchase of new Apple Machines." (Timeline: 50 years of computing, 1997).

Along with Apple, the IBM compatible computer increases its popularity with the public and the amount of software available for the IBM compatible computer increases. Microsoft's release of Windows 3.0, along with a large promotional campaign reportedly costs the company 10 million dollars (Timeline: 50 years of computing, 1997). As anyone can see there is a great battle going on between companies to gain a large portion of the market share for computers and the accompanying software.
Not only did computers and their software continue to get faster and better but so did the peripherals that went along with computers such as printers, monitors and scanners. The HP ScanJet introduced in 1991, allowed the computer user to scan color images and import them into the computer (Timeline: 50 years of computing, 1997). This technology allows for new avenues for graphic designers and printers to import images into digital format for use in computer programs.

With the competition among companies rising to gain more of the market share in computer hardware and software a unique alliance was formed among companies. This unique alliance developed the PowerPC family of RISC microprocessors. This alliance consisted of Apple Computers, IBM and Motorola (Timeline: 50 years of computing, 1997). Two years later in 1993, "The first Pentium-based PCs hit the market. For about $5,000, you can get a 66-MHz system with 16MB of ram, a 340 MB hard drive, a 1.44 MB floppy disk drive and a 15-inch monitor." (Metz, 2001). The technology used by computer companies continues to grow at exponential rates. Not only in the area of computer processors but also in the storage of information from hard drives to floppy disks. In 1994, "Iomega introduces its Zip drive and Zip disks" (Timeline: 50 years of computing). The new line of zip drives allow for more information to be stored on one floppy disk. Today we use writable CD’s, DVD’s and portable USB drives the size of a human finger to store information.

All major computer hardware and software companies continued to grow as the middle of the 1990’s was reached. In 1995 Windows 95 was released by the Microsoft Corporation with one million copies sold in the first four days by retail channels (Timeline: 50 years of computing, 1997). At the same time Apple continues to produce
computers. Steve Jobs comes back to Apple as the interim CEO in September of 1995 after leaving Apple and forming two other companies in 1985 and 1986 (Metz, 2001). Apple continues to bring new products onto the market and in August of 1998, “Apple makes a splash with its Bondi Blue iMac. For about $1,300, customers get a machine with a 233-MHz G3 processor, a 4GB hard drive, 32MB of RAM, CD-ROM, and a 15-inch monitor” (Metz).

At the same time computer hardware increased its speed through new technology. The first Pentium III based PC was introduced and made available for the consumer in 1999 (Metz, 2001). For $3,160 the customer would receive, “…a 500-MHz system with 128MB of RAM, a 20GB hard drive, and Omega Zip Drive, a DVD drive, and a 19-inch monitor…” (Metz). As technology continued to move forward the speed of computers increased along with the pace at which the new technology is available to the customer. The price of computers along with computer components continued to drop as the price of the technology becomes cheaper and is cheaper to produce. If you compare the Pentium III above with the Pentium 4 released in November of 2000 the price dropped from the Pentium III costing $3,160 dollars and the Pentium 4 costing $2,500 dollars (Metz). Also with the Pentium 4 the costumer received more speed and a system that was configured with “…a 1.5-GHz system with 128MB of RAM, a 40GB hard drive, a CD-RW drive, a DVD drive and a 19-inch monitor” (Metz).

The use of Computers in Schools

School officials everywhere have to deal with technology in their schools. A major portion of dealing with technology is using computers in schools. Computers in schools have become more and more prevalent over the years. Computers are used for
many different tasks in schools from administrative duties to student research. "Without a doubt, technology is impacting the way instructors teach and students learn" (Trends in computer hardware, 2001). The idea that technology will change the school environment is not a new thought, in 1913 Thomas Edison discussed the idea that books would no longer be used to disseminate information. (Landry, 2002). Edison had just invented the Kinetophone, which was an early device that was capable of synchronizing sound and a projected image together (Landry). Computer use and trends in schools across the nation vary from year to year.

In the State of Wisconsin there was one instructional computer for every 3.1 students in 2001 (Access to Technology, 2002). The State of Wisconsin has more computers than the national average which was one instructional computer for every 4.2 students (Access to Technology). One area of computer statistics that is often looked at in education is the amount of Internet access students have. In the State of Wisconsin there was one Internet connected computer for every 5.6 students compared to a national U.S. average of one Internet connected computer for every 6.8 students during 2001 (Access to Technology).

With the amount of computers used in schools, computer companies work hard to take as much business from education as possible each year. Companies produce products that are directed towards schools to gain a larger share of the computer market. "Apple has always had the vision that computers can be a means to prepare students for the future and to help them realize their potential" (Trends in computer hardware, 2001). Apple has been in the education market from the beginning with the Apple IIE, which, "...was one of the first computers to gain a place in schools nationwide and still
dominates the technological scene at many schools that lack funds to upgrade" (Another one bites the dust, 1998). Apple is just one company that is continuing to work at selling as many computers to the education market as possible. In April of 2002, Apple Computers introduced the eMac, which was designed at first for the education market and caught on in the consumer market later on. The eMac was the most affordable G4 system to date at the cost of 1000 dollars, the price could help catch the eye of school officials in charge of purchasing computers (New eMac, 2002). The purchasing of computers by school officials can definitely be a tough task when budgets are tight and getting smaller in schools. However, schools continue to see the need to spend money on computers. In the September 13, 2002 edition of Electronic Education Report they state, "Total computer sales to the K-12 and college education markets for the third quarter will reach 1,353.6 million, according to Simba Information projections" (In K-12 and College, 2002). Dell's quarter two-market share was 34.6%, roughly $536.2 million in sales (In K-12 and College). Apple was a distant second at 15.1% or $234.3 million, third was Hewlett-Packard with 9.5% or $147.9 million, fourth was Gateway with 8.1% or $124.8 million, and fifth was IBM with 5.2% or $80.1 million (In K-12 and College). Charles Haddad states on September 19, 2002, "Apple is losing its long-held dominance in schools. More Macs are still in place than PCs, but that lead is eroding like a sandcastle in the rain. Apple’s sales are falling farther behind as schools increasingly choose PCs over Macs”.

With the mass amounts of money being spent on computers for education there was a trend found in current literature about computers in schools. This trend identified by Trends in Computer Hardware (2001) is one that includes the use of laptops and
wireless technology to upgrade their computer technology, the use of laptops may allow for more freedom of where the computers are used. “Organized laptop programs in higher education date as far back as 1988 when Drew University in Madison, NJ, began providing notebook computers (paid for from tuition) to all incoming freshmen” (Belanger, 2002). K-12 institutions are using laptops in their schools around the nation.

“Students from the largest urban school district in New York City have been able to bridge the Digital Divide through a cost-sharing laptop leasing program, Mac@Home, with Apple Computers” (Zardoya & Fico, 2001). The unique part of this laptop program is that students have the ability to take the laptop home with them after school instead of leaving it at school with half of the cost being taken care of by the school district and the other half by the home and at a cost of $1.00 the students can purchase the laptop after the 36-month leasing term is expired (Zardoya & Fico). Apple is not the only company promoting the use of laptops in schools. Other companies such as the Microsoft Corporation, Toshiba, NetSchools, and NoteSys Inc. are promoting the use of laptops in schools (Belanger).

The reason for using laptops may vary by each school district or state. One-reason schools are looking at using laptops over desktops in their schools is that choosing a mobile wireless system allows students to go up to 150 feet away from the hub and they only have to run one wire to the wireless hub, instead of multiple computers (Trends in computer hardware, 2001). Another reason that laptops are a good alternative is that, laptop computers with wireless technology can be moved around or rearranged at the teacher’s discretion or moved from room to room (Belanger, 2002). “Laptops can also take the place of desktops in a traditional lab setting” (Belanger). “...the Cuba-Rushford
School District in Allegheny County, NY, created a 70-computer laptop lab and gave students the option of checking out the laptops for home use (Belanger). Laptops give all students opportunities to computers after school, which is not possible with desktop computers (Belanger).

Computer Hardware and Software used by the Printing and Publishing Industry

The computer has had a dramatic change on the way the printing and publishing industry operates. From the way printed documents are laid out, the way these files are submitted to the printer and to the way the printing plate is created for the press and to the way printing jobs are kept track of as they go through different production phases. Hurlburt (2000) defines the prepress process to include, “...typography, page layout, inputting photographs and other images, assembling finished pages, proofing for accuracy and color fidelity, combining individual pages into multi-page ‘signatures’ corresponding to press plates, and producing final plates for mounting on the press.” Cutshall (2002) writes, “Typesetters, platemakers, paste-up workers and film strippers are fast being replaced with graphic designers/desktop publishers and others who have mastered the electronic aspects of the various printing process.” As is shown, the technology enhancements that computers bring to the industry will continue to grow and influence the printing industry in the future.

As previously stated above, the first way that the computer changed the way the printing and publishing industry operated was the way printed documents were designed and laid out. The area of graphic design has been immensely impacted by the growth of the computer hardware and software industry. Thornton (1996) states, “The real change in graphic design occurred when computer type and image software became a primary
tool for the (graphic design) professional in the 1980's.” Previous to the computer the graphic designer “...needed only to create the concept, seek approval from the client, and assemble the mechanical or finished art to produce the printed piece.” (Thornton).

“Historically, designers relied on outside professionals, such as typesetters and printers, to provide technical results of their trade” (Thornton).

Desktop publishing came about in the middle 1980's courtesy of the Macintosh computer developed by Apple Computers and a computer program titled PageMaker, which was produced by the Aldus Corporation (Goldborough, 2002). Macintosh computers along with the Aldus Corporation may have been the first in desktop publishing but Goldborough (2002) writes, “Both are still around. But Windows-based PCs are as capable as Macs for this purpose if still more difficult to use...” PageMaker is now owned by Adobe, but most professionals use QuarkXPress (Goldborough). The argument between Mac and IBM compatible PCs will always exist but in the printing and publishing industry, one stands out over the other. David Em (2002) writes, “The publishing industry has always been a Mac stronghold...”

The use of the computer in graphic design greatly enhanced the area of typography. With the Macintosh computer introduction, a new era in typography was developed (Staples, 2000). Thornton (1996) writes, “The computer also provided major changes in the availability of type fonts.” Before the computer, a graphic designer needed to be close to a type house to have access to a large variety of fonts. (Thornton). “The computer enabled designers to create and manipulate letters in new ways, offering new options for crafting letterforms and ‘outputting’ them--whether in the medium of toner particles on paper, or pixels on a screen (Staples). The early Macintosh computer systems
allowed the user to choose from a variety to type styles and alter those styles by bolding, italicizing, underlining or changing the size of the text or the designer could choose all of those options at one time (Staples). Thornton writes about a very important impact that computers had on the money involved with using different text styles, "For a few pennies a computer user can have access to just about any script, sans serif, serif and decorative faces that have been around for 150 years."

Typography was not the only area that was greatly enhanced by the advent of the computer. Working with computers graphic designers now had the capability of importing in text and artwork to the computer to alter, touch-up, or even simply create their own artwork with the help of numerous programs available to them. Gold (1998Dec) writes about the difficulty of measuring the impact that digital photography and scanning technology has had on the prepress industry. This impact has grown since the introduction of computers into graphic design and continues to influence the prepress industry in the future.

There are three distinct categories of software used in prepress. These categories of software are: drawing software, image manipulation/photo editing software, and page layout software. Each of these categories has many different brands of software available to the printing and publishing industry to meet the demands of what the industry is looking for. There is great competition among companies to get their hold of software used by the printing and publishing industry. In each category, there are many different software available to choose from and many companies run more than one type of software for each category. As you will see in each of the software categories described below there are numerous quotes that promote different software which can make it
difficult to choose what software to purchase. These are just samples of quotes from current articles.

Drawing software is used by someone to draw digital artwork. Many designers use drawing or illustration software to create images now matter how good they can draw (Dudrow, 2002). Adobe Illustrator, CorelDraw, and Macromedia FreeHand are just three of the different software available for artists to use. "...Adobe Illustrator has dominated the illustration market, CorelDraw is now the application to beat, delivering first-rate text features that rival desktop publishing programs, along with the most flexible vector drawing tools..." (The right combination, 2001). Adobe Illustrator which is used for creating and editing different vector formatted images, is the leader in the drawing software category (Olsen 2002). Just because a software is a leader in the market does not make that software the easiest or best to use. "Adobe Illustrator is widely accepted as the industry standard, but to our surprise, CorelDraw offers more flexibility" (CorelDraw 10, 2001).

Image manipulation/photo editing software are programs that allow the user to change, touch-up photographs, and combine photographs. The majority of articles supported Adobe Photoshop as the front-runner in this category. "Adobe is in many respects the founder of the desktop image-editing market" (Adobe Photoshop 6.0, 2001). "Adobe Photoshop is easily the most life-changing program in publishing history. It is the cornerstone of print and Web publishing..." (Blatner, 2000). It seems Adobe Photoshop is the clear choice for many when it comes to working with photographic images by editing, combining and manipulating them (Kings of the hill, 1999). PC World evaluated three different software programs: Adobe Photoshop 5, Corel Photo-Paint 8, and
Micrografx Picture Publisher 8 and found all the different software packages to include the extras to persuade consumers to purchase their software (Kings of the hill). “There are other imaging programs besides Photoshop, but Adobe has a significant leg up on its rivals, because most designers are using its programs” (The complete picture, 2001). Picture It! By Microsoft is another software that allows you to edit images but also includes some features that allow the user to do some page layout work using the software (McQuin & Minkel, 2001). PhotoRetouch was just one example of a new software to come onto the market to compete with other image editing/manipulation software (Ashcroft, 2002). David Blattner (2000) lists the following programs that have been defeated by Adobe Photoshop: “Color Studio, Digital Darkroom, PixelPaint, PhotoPaint, ColorMacCheese, Color-It-Pro, xRes, Live Picture and Quark Xposure.”

The last category of software is page layout software. Again, in this category there are many different beliefs about what software is the correct one to purchase and use. Parsons (1999) writes about Microsoft Publisher which, “is usually classified as a ‘consumer’ product, as contrasted with ‘professional’ layout and design tools…” “It is aimed at small-to-medium size business users who are looking to reduce costs of producing print collateral pieces, such as brochures, catalogs and flyers” (Parsons). Being a consumer product, Microsoft Publisher, does not match up to the complexity of what can be created using Adobe PageMaker, Adobe InDesign or QuarkXPress (Parsons). PageMaker, which was previously mentioned, and Ventura Publisher are page layout software programs that were mentioned in other current articles identified about page layout software. Ventura Publisher by Corel released version 10 of their software, which was the first upgrade to the software package in four years (In the Bulletin, 2002).
Gruman (1997) writes, "PageMaker launched the desktop publishing revolution one year before QuarkXPress hit the shelf, but ever since the two have battled fiercely to be the market's best." QuarkXPress has won that battle since the early 1990's when the battle between Adobe PageMaker and QuarkXPress subsided (McClelland & Blatner, 2000).

The big battle continued between different page layout software programs now the battle is between QuarkXPress and Adobe InDesign. "... QuarkXPress has enjoyed dominance as the package of choice for desktop publishing pros" (Simone, 2002). The competition between Adobe and Quark started with Adobe's purchase of Aldus PageMaker (Camp, 2002). The competition between the two companies came to the forefront when each company issued new versions of their page layout software (Camp). Blatner (May 2002) writes, "Most print designers and prepress professionals use QuarkXPress 3.x or 4.x [or higher versions] — not because Xpress is a flawless program, but because its features, familiarity, and prevalence make it cost-effective." With the introduction of InDesign 2.0 the choices for those upgrading their page layout software, now have an option besides QuarkXPress (Blatner, Jan 2002). "Even if Adobe can convince designers that InDesign is a better product, they still have to get them to switch from a product they're comfortable with" (Camp).

Blatner writes in January 2002:

For a long time, the publishing world has wished for a serious competitor to QuarkXPress—if only because such a program would spur Quark to become more innovative. You couldn’t call Adobe’s new offering a "Quark killer," but it will probably cause a number of people to switch,
especially designers who highly value features such as transparency, redefined type handling, and high-quality screen previews.

Besides the area of graphic design, the computer has also revolutionized the rest of the prepress process from submission of files to the creation of negatives or plates to print the final project. The way that the customer submits the file to the printer has changed since the integration of computers in the printing industry. The conventional method of submitting files to the printer was to have someone cut and paste the printed project together by hand or by the use of the computer. That paper copy was then supplied to the printer to go through the rest of the conventional prepress process—shooting negatives, stripping flats and exposing plates. Now the customer has many options to submitting the printing project with the use of the computer from saving the file on to a disk or CD to sending the information over the Internet.

With these new options, the customer has the option of submitting the digital file using an application file like QuarkXPress or Adobe InDesign or submit the file using a newer program to submit files to the printer, which is a PDF file that is created in Adobe Acrobat. Craft (2002) writes, "A PDF File can originate from a word-processed or desk-top-published document, CADD Drawing, or graphic image file and maintain the quality of the original form containing text and pictures." PDF files include information on the fonts, graphics, pictures and any other color information all in one file (Gold, 1998Dec). As explained in John Craft's (2002) article you can create a PDF using the following page-layout applications: Adobe PageMaker, Adobe InDesign and QuarkXPress.

As with any new product use in any industry including the printing and publishing industry there are some problems with working with PDF files. Gold (1998Dec) writes,
"The trouble is if there is a problem with elements in the file, editing (a PDF) is more difficult than with application files (although plug-ins are helping)." To help edit a PDF the user can purchase Adobe Acrobat, which allows the user to not only create the PDF's but also edit existing PDF's (Zwang, 2002). With the use of PDF's in the printing industry, other software companies are developing software plug-ins to help designers work with PDF files in the printing industry (Gold, 1998Jun). Gold (1998Jun) defines what a plug-in is "A plug-in is software that adds special features and functions to another application..." In David Zwang's 2002 article in American Printer he mentions some PDF-editing tools for the printing industry that are plug-ins, they include PitStop which was developed by Enfocus software, PDF ImageWorks created by Lantana Software, and ImageAlter developed by Apago.

Not only is the process of submitting files to the printer changing because of the computer. The way we transfer the image from the computer to the printing plate has changed because of the increase use of the computer in the printing and publishing industry. In today's printing industry the push is to go to computer-to-plate technology or what is known as CTP.

Schmidt (1996) describes the traditional method of prepress:

Under the traditional, film-base system, pages are assembled ("stripped") as "flats," one for each separated color. The flats can be proofed for last-minute checking and correctional changes. These films, comprising an entire form, are then burned onto offset plates for processing and printing.

"CTP enables publishers to supply printers with digital information to image plates directly for offset printing" (Falcioni, 2001). At the American Newspaper
Publishers Association the first mention of CTP happened in 1976, though theories of CTP may have previously existed (Schmidt, 1996). CTP continues to catch on in the printing and publishing industry. Computer to plate technology will continue to be adapted by more and more companies as the technology evolves (Gold, 1998Dec). In Graphic Arts Monthly (Taking it to Printers, 2001) they discuss the fact that printing companies want to adapt CTP technology, the problem that exists is in implementing the technology into their current operations. As companies solve the implementation problems of CTP technology, CTP should increase.

Companies have been acquiring different types of CTP technologies, which have many advantages depending upon what type of printing process you are using. The United States Government Printing Office released a press release on April 30, 1998 stating: “The Government Printing Office (GPO) is acquiring state-of-the-art computer-to-plate technology that will dramatically reduce costs, improve press-ready plate quality, and expedite the processing of prepress work.” For someone trying to visualize what a computer to plate plate-setter looks like, imagine the image setters that produced film in the past, now a laser is used to etch metal or plastic plates (Schmidt, 1996). CTP plate-setters can range anywhere from small two to four pages platesetters up to platesetter that can handle eight to sixteen pages on a plate (Schmidt).

In the same news release from the United States Government Printing Office (1998) that was mentioned above, they explain the advantages that CTP brings to them:

Establishing networked, high-speed, fully automated platemaking capabilities saves substantial labor costs. CTP technology makes it possible to send electronic text and image files directly to automated
platemaking devices, eliminating the need for film negatives and the additional labor-intensive manual processes of stripping and imposing those negatives onto goldenrod for conventional platemaking. It will also ensure consistently high quality plates. As a result, GPO will be able to deliver the same volume of quality print products to Congress and Federal agency customers at a significantly reduced labor cost.

Falcioni (2001) discusses the advantage of flexibility, by being able to make last minute changes, that CTP brings the industry by combining with digital proofs to allow those changes to be made without having to start the prepress process over. The United States Government Printing Office (1998) also discussed other ways that CTP is beneficial such as saving cost on film, chemicals and recycling of those products and how it reduces hazards to the environment.

With all the great aspects of CTP there are people that still are not sure about going totally to CTP, they do not want the technology to produce the exact copy they wanted, thus they still want to see traditional proof sheets (Falcioni, 2001). As previously mentioned last minute corrections with CTP do not require new negatives and flats, but the downside is small corrections cannot be stripped in to make the change (Schmidt, 1996). Schmidt sums it up, “Nevertheless, the advantages of CTP in the general context of printing technology appear to be overwhelming.”

**Computers and Software for High School Graphic Communications Programs**

Making the choice on what computer brand, operating system and what computer software to choose for drawing, image manipulation, and page layout for a high school
graphic communications program can be difficult. As previously shown in Chapter 2 there are many options to choose from when purchasing computers, which is just the beginning of starting the purchasing process.

The purpose of the computer in the graphic communications lab and classroom is to provide a tool to learn about the printing and publishing industry. By using the current computers and software that the printing and publishing industry is using, you are providing the student with one of the best tools to learn about the printing and publishing industry.

On August 15, 2001, Charles Haddad writes about the graphic arts lab at his son’s school:

Located in a wealthy Atlanta suburb, it’s the top-ranking school in Georgia. Yet its graphic arts studio is powered by decade-old Macs running on OS 7.6, an operating system that hasn’t been on the cutting edge since my son was in kindergarten. OS 7.6 can’t handle today’s versions of Adobe and Quark software. Which means kids in my son’s school are learning yesterday’s graphic skills. The teacher recognizes the problem but can’t persuade the school to finance and upgrade to OS 9, let alone buy new Macs.

By using the current computer hardware and software you are not only teaching the student about the printing and publishing industry you are also teaching them skills that can be used to help them in their continuing graphic communications education or in securing a job in the printing and publishing industry. In the May/June 2000 issue of Tech Directions the magazine writes, “DTP specialists will usually work with Macintosh computers and are generally expected to know: * PageMaker * QuarkXPress * Illustrator
* Freehand * PhotoShop* (Career Directions, 2000). This identifies one example of the expectations of someone coming into the desktop publishing industry. Foley (1999) discusses teaching students about transferrable skills and how this has become a popular methodology in education. Teaching students different transferrable skills allows the student to move on to their next step in life with the knowledge and skills to build on and they may be a step ahead of others by possessing these skills. Transferrable skills can be defined many different ways, for the purpose of this research it is any skill that can be used at a later date in time.

Skills can be taught with many different approaches. A very popular teaching methodology of teaching in Technology Education where students learn about different technologies along with skills is the "hands-on-learning" approach. Edward Heffernan is quoted in the 2001 Curriculum Review as saying, "By taking a hands-on approach to learning, I have found that all students, regardless of their academic levels, can be successful" (Inspiring words, 2001).

Morris Tischler (1997) expands on Heffernan's thoughts about hands-on-learning:

Hands-on learning. The saying "learn by doing" is a truism. I am convinced that I learn with my hands. If I am told something or read about it, I may or may not remember it. If, however, I am required to perform a task using my knowledge, I will associate it, relate it and internalize it. I will remember what I learned.

With hands-on learning being such an important facet of Technology Education, choosing a quality computer system to teach students is even more important. Students will be using the computers as their learning tool to learn about graphic design. At the
same time, the computer must allow for the teaching of transferable skills so students have a knowledge and skill base to use in furthering their education or landing a job.

Choosing computer hardware and software can be difficult in a school setting. There are many different facets besides the skills and knowledge to be taught, that must be considered such as the brand of computer, technical support by the school district, networking to other computers, other possible uses of the computers, upgrading possibilities and overall cost of purchasing the computer systems.

Choosing between a PC and a Macintosh computer can be difficult for a school situation where funding for technology can be limited and the technical support for the Macintosh computers may not exist. Many schools use students to troubleshoot and fix computer problems, and to work on the computer network (Trotter, 2002). This statistic shows the wide variety of technical support that a district may have for its computers, from professionally trained people to students. Depending upon the technical support provided by the district a Graphics Instructor might be on an island and have to provide their own technical support for certain computer brands.

Along with technical support for repairing the computers, networking those computers to the school network may be a problem. This problem may be even more difficult depending upon the level of technical support that may or may not exist in the school district as shown above. With all of the difficulties of networking computers of the same brand, networking computers of different brands or operating systems can be difficult without the proper technical support. Some school districts have gone as far as phasing out certain brands of computers. West Bend school district, in their technology
plan, mentions they will be phasing out Macintosh computers during 2002-2003 (Sklar, 2001-2005).

Another big question that must be answered is: How often do I need to upgrade and what is the capability of upgrading the computer hardware? How often one upgrades can be difficult to decide but in most schools this is based upon the availability of money. Purchasing a computer that is very capable of being upgraded is very important along with the price of the upgrades. Some computer companies have introduced computer systems specifically aimed at the education market. One example is Apple's eMac, which was developed for the education sector (Dreier, 2002). These computers may cost less and physically intrigue the consumers but when reviewed there were some problems with the eMac. Jason Snell writes in 2002 about the eMac and the upgradability of the product: "Unscrewing the panel was relatively easy and provided clear access to the two RAM slots, but a glance inside suggested that upgrading any other part of the eMac would be a harrowing experience..." Purchasing a computer that can be difficult to upgrade or can not be upgraded may cost more in the long run because new systems may need to be bought sooner than those that can be upgraded.

The last thing that must be looked at when purchasing computers for a specialized area such as Graphic Communications is who else these computers can be used by in the Technology Education department or other departments. In the Technology Education department the computers can be used for classes dealing with photography and digital photography, radio broadcasting, and certainly digital video editing. Other areas around the school that may use the computers would be the schools art department to draw computer artwork, the school newspaper, and the schools yearbook.
Chapter Three

Chapter three will discuss the methodology of the research. It will cover the following areas: research design, sample selection, instrumentation, procedures followed and the method of data analysis. The chapter will start by looking at the design of the research.

Research Design

The research that was completed with this project was quantitative in nature. The research is quantitative in nature because the research tries to describe the current state of multiple items by mathematical representation. The research in this study is also descriptive in nature because the purpose of the study was to identify what computer hardware and software are currently being used by the Graphic Communications industry and related printing industries in Wisconsin. The research was also conducted to compare the demographics of the different companies to the type and/or amount of computer hardware and software used by those companies in different relationships.

The research for this project was sought after not only to identify and compare what companies were using for computer hardware and software but also to create a database for Technology Education teachers to use in purchasing new equipment for their Graphic Communications programs. This database may help them in choosing what computer hardware and software to purchase and help validate the need for their purchase and/or upgrade.

Sample Selection

The subjects for this study were 150 randomly selected members of Printing Industries of Wisconsin with addresses that were in the State of Wisconsin. The
researcher assigned a number to each one of the 176 companies in the population that had
addresses in Wisconsin and then used a randomizing software that chose 150 random
numbers from the total of 176 to survey for the study. The companies in the population
included many different types of printing companies from package printers to service
bureaus and range in size from a couple of people working in the printing area to a
complete company that is focused on printing and publishing. Each Printing Industries of
Wisconsin Member with an address in Wisconsin had an equal chance of being chosen to
participate in the study no matter what type of company they were.
Instrumentation
The survey for this research was created in the summer of 2002 by the researcher
for this research project and then reworked as chapter two research continued. The final
survey questions were set in the fall of 2003 (appendix B and D). The first part of the
survey, questions one through 5, were designed to identify the following demographics of
the sample population: company size, number of employees working in the prepress
department, category of company, the job title of the person filling out the survey and the
department that the person filling out the survey works in. The second portion of the
survey, questions six through eight, were designed to answer the following questions: the
percentage of incoming work that is submitted digitally or conventionally, the
percentages of digital files being submitted using application files versus PDF Files and
the percentage of files that are sent to press traditionally by shooting negatives, stripping
flats and burning plates versus using computer-to-plate technology. The third portion of
the survey, questions nine through 13, were developed to identify different computer
brands and operating systems including versions being used, different drawing programs
and versions used including the percentage of files that use each program, different image manipulation/photo editing programs and versions used including the percentage of files that use each program, and different page layout software and versions used including the percentage of files. A copy of the full instrument used for this research can be found under Appendix B and D. The survey was copied on 11"x17" paper so four 8.5"x11" pieces of paper could be placed on it back to back. The copies were then folded to create a booklet. The first page consisted of the cover letter and the next three pages consisted of the survey questions and a reminder on the final page of when to return the survey.

Procedures Followed

As the process of developing this research project moved along, the researcher went through the Human Subjects Training Certification approval process online from UW-Stout and gained permission from the IRB Board to complete the research for this project. Once the researcher gained approval, the researcher looked at surveying companies that had hired past graduates of Wisconsin Technical Colleges and their printing and publishing programs to survey.

The researcher contacted the different technical colleges that had a printing and publishing program for information on these companies. Some of the technical colleges offered just the names of the companies, some offered more company information and some would not offer any at all. This represented one problem in getting a quality sample group to survey. Another problem that arose was in regards to the fact that some colleges made available only one year of placement information while others made available multiple years. As the researcher and his advisor looked at the number of companies that would make up the population to survey the advisor suggested contacting Printing
Industries of Wisconsin to see if the researcher could gain access to the addresses of their members to survey for this research and increase the population size. Upon contacting Printing Industries of Wisconsin the researcher received a copy of the addresses of all the members and the decision was made to use those members instead of companies that hired graduates from the Technical Colleges.

Once the researcher received the addresses and the survey instrument was approved by the research advisor a number was assigned to each of the different companies in the population from Printing Industries of Wisconsin. The researcher then used an online research randomizing software that selected 150 random numbers that would correlate to the 150 companies that would receive surveys out of 176 total companies in the population. This was completed on 11/11/03 using the website http://www.randomizer.org. The researcher then proceeded to get ready to mail the first set of surveys to the 150 companies that were selected.

Each survey was marked with a number that correlated to a company on the address list. This allowed the researcher to identify who returned their survey so a follow-up survey could be sent to those that did not respond. The first mailing of the survey (appendix A and B) was sent out on January 1, 2004 in Brown Deer, Wisconsin. The researcher asked for the surveys to be returned in the addressed and pre-paid envelope by January 14, 2004. At that time 64 surveys had been returned.

A second set of surveys, consisting of 86, were sent out to those companies that had not responded to the first mailing on January 22, 2004 from Berlin, Wisconsin. This second survey included a different cover letter (appendix C and D) and a copy of the survey. The second cover letter stressed the importance of the survey in helping create a
database of information for high school Technology Education teachers. The respondent was asked to return the second survey by February 6, 2004. The second survey was marked with the companies' confidential identifying number and a two so no company could respond twice. Overall out of 150 surveys sent out, 79 of the surveys were returned. Of those 79 surveys, 13 were returned with a note stating that the survey did not pertain to their business as they did not deal with the prepress portion of the printing and publishing industry.

Method of Data Analysis

After the surveys were received the researcher compiled the data into a large spreadsheet with all of the answers from the respondents. The first method that the data was analyzed was by reporting the answers in tables by grouping together similar answers into categories and reporting them in tables. Also, the average was found of all respondents for the questions where average was appropriate and reported in a table.

The data was further analyzed by comparing different answers or categories of answers versus another answer to find out if there was a correlation between one answer and another. One example of this data analysis would be a correlation between the size of a company and the amount or type of computer they used.
Chapter Four

This chapter will include the data analysis and reporting of the descriptive research that was done to identify what computer hardware and software are being used by the Printing and Publishing Industry of Wisconsin. This chapter will also identify any correlations that exist between certain datasets of demographic information and computer hardware and software and between file submission and computer hardware by making comparisons using charts from Microsoft Excel. The first portion of the data analysis will report the demographic information that was found through the research. The second portion of the data analysis will report on the number of respondents in each category and/or the average of their responses in regards to questions relating to computers, software and computer file usage. The third and final portion of the data analysis will compare the demographic information with the responses relating to computers, software and computer file usage. This section will report on any correlation between a demographic answer and the questions about computers, software and computer file usage.

Rate of Response

A total of 150 survey instruments were sent out to the randomly selected sample of Printing Industries of Wisconsin member companies. Out of those 150 instruments 79 of the survey instruments were returned to the researcher which gave a rate of response at 52.666%. Of the 79 surveys that were returned to the researcher 13 of the instruments were returned by the population stating that though they were a member of the Printing Industries of Wisconsin the survey did not pertain to the type of printing work that the instrument was asking about. This left a total of 66 usable surveys out of 150, or 44%.
The responses summarized in this chapter may show variation in the total number responding due to the failure of some respondents to respond to every item on the survey. This will be noted under the figure or table summarizing those responses.

**Demographic Questions**

The first item asked respondents to identify the number of employees that work for the company. Table 1 shows the representation of the responding population and the percentage of the population they represent from the 66 respondents. The largest representation came from the 101-250 employee range which made up 22.73% (n=15) of the respondents. The smallest representation came from companies with 1001 or more employees.

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>Frequency (n)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 or less</td>
<td>5</td>
<td>7.58%</td>
</tr>
<tr>
<td>11-25</td>
<td>6</td>
<td>9.09%</td>
</tr>
<tr>
<td>26-40</td>
<td>7</td>
<td>10.61%</td>
</tr>
<tr>
<td>41-50</td>
<td>12</td>
<td>18.18%</td>
</tr>
<tr>
<td>51-60</td>
<td>6</td>
<td>9.09%</td>
</tr>
<tr>
<td>81-100</td>
<td>5</td>
<td>7.58%</td>
</tr>
<tr>
<td>101-250</td>
<td>15</td>
<td>22.73%</td>
</tr>
<tr>
<td>251-1000</td>
<td>6</td>
<td>9.09%</td>
</tr>
<tr>
<td>1001 or more</td>
<td>4</td>
<td>6.06%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 1. Number of Employees

Item 2 asked for the number of employees that work in the prepress department, which is very pertinent to this descriptive research. The prepress department is the department that would be using the majority of the computer hardware and software.
related to this study, dealing with the incoming files from customers and getting the file to press to be printed. Table 2 shows a breakdown of the number of employees in the prepress department by frequency (n) and the percentage of the overall responding population they represent.

<table>
<thead>
<tr>
<th>Number of employees in the prepress department</th>
<th>Frequency (n)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1.52%</td>
</tr>
<tr>
<td>1</td>
<td>5</td>
<td>7.58%</td>
</tr>
<tr>
<td>2-3</td>
<td>10</td>
<td>15.15%</td>
</tr>
<tr>
<td>4-5</td>
<td>8</td>
<td>12.12%</td>
</tr>
<tr>
<td>6-10</td>
<td>19</td>
<td>28.79%</td>
</tr>
<tr>
<td>11-20</td>
<td>10</td>
<td>15.15%</td>
</tr>
<tr>
<td>21-40</td>
<td>8</td>
<td>12.12%</td>
</tr>
<tr>
<td>41 or more</td>
<td>4</td>
<td>6.06%</td>
</tr>
<tr>
<td>No answer given</td>
<td>1</td>
<td>1.52%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 2. Number of Employees in the Prepress Department

Item 3 asked the respondents to categorize their companies by type of business. The respondents were given eight different categories and an other option to choose from. Respondents could choose multiple categories for this question as their business may fit into multiple categories so the total number in the table is larger than the number of respondents to the survey. Table 3 represents the different types of companies and the frequency of each response from Item 3. If the respondent chose the “Other” option they
were asked to indicate their type of business. These different businesses are listed below the “Other” option below in table three. The most frequent response listed was “Commercial Printer” with 35 responses with the second most frequent response being “Catalog/Publications Printer” with 10 responses.

<table>
<thead>
<tr>
<th>Type of Company</th>
<th>Frequency (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Printer</td>
<td>35</td>
</tr>
<tr>
<td>Catalog/Publications</td>
<td>10</td>
</tr>
<tr>
<td>Trade Shop</td>
<td>4</td>
</tr>
<tr>
<td>Book Prizing</td>
<td>5</td>
</tr>
<tr>
<td>Quick Print Shop</td>
<td>5</td>
</tr>
<tr>
<td>Package Printing</td>
<td>4</td>
</tr>
<tr>
<td>In-Plant Printing</td>
<td>9</td>
</tr>
<tr>
<td>Label Printing</td>
<td>4</td>
</tr>
<tr>
<td>Other</td>
<td>7*</td>
</tr>
</tbody>
</table>

Other Responses: Digital Printer, Promotional, Point of Purchase – Plastics, Direct Mail, Point of Purchase, Book Composition and Print Orientated Marketing.

*1 response for each other company type listed.

Table 3. Type of Company

Item 4 on the survey instrument was designed to identify the job title of the person responding to the survey. Respondents were asked to list their current job title.

With many different titles essentially encompassing the same job duties or similar duties the titles were placed into one of five different categories. These categories were: CEO/President/Owner, Vice President, Management, Information Technology/ Information Systems/Computer Support and other. The other job titles are listed in Table 4. There was one respondent who left this question blank. The breakdown of Item 4 is summarized in Table 4, by frequency and percentage of the responding population shows that the most frequent response came from someone who was in a management position.
and the second most frequent person to respond to the survey was the CEO, President or Owner of the company. Of the 66 respondents to the survey 54 of them were from the management level within the company.

<table>
<thead>
<tr>
<th>Job Title</th>
<th>Frequency of Response (n)</th>
<th>% of the Responding Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEO/President/Owner</td>
<td>17</td>
<td>25.76%</td>
</tr>
<tr>
<td>Vice President</td>
<td>10</td>
<td>15.15%</td>
</tr>
<tr>
<td>Management</td>
<td>27</td>
<td>40.91%</td>
</tr>
<tr>
<td>IT/IS/Computer Support</td>
<td>6</td>
<td>9.09%</td>
</tr>
<tr>
<td>Other: Preflighter, Electronic Prepress Technician, Digital Prepress Technician, Treasurer, Communications Director</td>
<td>5</td>
<td>7.58%</td>
</tr>
<tr>
<td>No Answer</td>
<td>1</td>
<td>1.51%</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4. Current Job Title

Item 5 asked respondents to identify the departments in which they worked. Because the responses to Item 4 were placed into discrete categories, they may not correlate clearly to the responses to Item 5. The purpose of Item 5 is to identify what departments within the companies were responding to the survey and being represented. The responses to Item 5 are summarized in Table 5. The prepress department had the highest representation with 26 responses or 39.39% of the responding population.
<table>
<thead>
<tr>
<th>Department</th>
<th>Frequency of response (n)</th>
<th>% of the Responding Population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepress</td>
<td>26</td>
<td>39.39%</td>
</tr>
<tr>
<td>Administration/Management</td>
<td>18</td>
<td>27.27%</td>
</tr>
<tr>
<td>Other: Graphics, Print, Marketing, Office, Print shop, Communications, Accounting</td>
<td>9</td>
<td>13.64%</td>
</tr>
<tr>
<td>All Departments</td>
<td>4</td>
<td>6.06%</td>
</tr>
<tr>
<td>IT/IS/Computers</td>
<td>3</td>
<td>4.55%</td>
</tr>
<tr>
<td>No Answer Given</td>
<td>6</td>
<td>9.09%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>66</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

Table 5. Department the Respondent Works In

File Submission and Going to Press

The second portion of the survey instrument was constructed to gather information about the start of the prepress process and identify the role of computers in this process. This process starts with how the files are being submitted to the companies that would be printing them. Item 6, asked the respondent to identify what percentage of incoming work to the company was being submitted using a conventional method versus a digital method. The conventional method of file submission includes submitting work in the following forms: page layouts, films or plates and the digital method of file submission encompasses all computer files no matter how they were received at the company - stored on a disk or transmitted in a digital format. Table 6 shows the range and mean responses for conventional vs. digital file submission. The range for conventional file submission is important to this study as no company reported more than 50% of their
printed items were submitted using the conventional method. Not only is the range important but the mean of conventional submission versus digital submission. This research found that 91% of files were being submitted by the digital format.

<table>
<thead>
<tr>
<th></th>
<th>Conventional File Submission</th>
<th>Digital File Submission</th>
</tr>
</thead>
<tbody>
<tr>
<td>Range</td>
<td>0%-50%</td>
<td>50%-100%</td>
</tr>
<tr>
<td>Average or Mean</td>
<td>450.6/66 = 6.83%</td>
<td>5975.4/66 = 90.54%</td>
</tr>
</tbody>
</table>

*Two survey respondents did not give a usable answer

Table 6. Conventional Versus Digital Submission of Files

Item 7 asked respondents to identify what digital file type was being used to submit the digital files to the company. The item asked the respondent to identify the percentage of files submitted using an application file, a PDF file and other software. An example of an application file type would be a QuarkXPress or Adobe InDesign document. The PDF stands for a portable document file which includes all the information (text style, pictures, and graphics) for a file that is to be printed in one encompassing file format. Also, if the respondent marked down other software they were asked to identify what software file type was used to submit the digital file. The largest percentages of files to be printed were submitted to the company using an application file. The range and average for the answers to Item 7 are shown in Table 7.
Table 7. Percentages of File Types Submitted

Item 8 asked the respondents to identify how the files to be printed were being prepared and sent to the printing press. The respondents were asked to identify the percentage of files sent to press by either the traditional method versus computer-to-plate technology. Traditional methods include shooting negatives, stripping flats and burning plates. Computer-to-plate methods image the plates directly from the computer file.

Seventy four percent of the files sent to press by the respondents were done by computer to plate technology. The average of all answers for Item 8 are presented in Table 8.

Table 8. Files sent to Press: Traditional vs. Computer-to-plate

Computer Hardware and Software Usage

The final portion of the survey was developed to identify the type of computer platform printing and publishing companies are using and what software they are using in the following categories: drawing software, image editing/manipulation software and page layout software. The survey also asked the respondent to give the approximate
percentage of files that came through their department over a two week period that used any of the software.

Item 9 asked the respondents to identify the number of computers in their department that were either a Macintosh computer or a PC (IBM Compatible) computer. Table 9 identifies the number of computers in each category, the percentage of the total that they represent and the average number of computers per company in each of the categories. Overall it was found that there were more Macintosh computers in use than there were PC (IBM compatible) computers.

<table>
<thead>
<tr>
<th>Number of Computers</th>
<th>Macintosh Computers</th>
<th>PC (IBM Compatible) Computers</th>
<th>All Computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>588</td>
<td>486</td>
<td>1074</td>
<td></td>
</tr>
<tr>
<td>Average or Mean</td>
<td>588/1074 = 54.75%</td>
<td>486/1074 = 45.25%</td>
<td>100%</td>
</tr>
<tr>
<td>Average Number</td>
<td>8.9 Macintosh</td>
<td>7.36 PC’s per Company</td>
<td>16.27 Computers per Company</td>
</tr>
<tr>
<td>of Computers per</td>
<td>Computers per</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Company</td>
<td>Company</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9. Number of Computers, Types and Average Computers per Company

Item 10 sought to find out what operating system was being used to run the computers that were being used in the respondents department. Overall the top operating system used was OS 9 on the Macintosh computer with 31% of the Macintosh computers running this operating system and coming in second was OS X which is also run on the Macintosh. The top operating system used for the PC (IBM compatible) computer was Windows NT with 13.68% of all PC computers. Table 10, breaks down all categories of the question that were responded to.
<table>
<thead>
<tr>
<th>Operating System</th>
<th>Total #</th>
<th>% of Macintosh Computers</th>
<th>% of PC Computers</th>
<th>% of Total Computers</th>
</tr>
</thead>
<tbody>
<tr>
<td>OS 8</td>
<td>51</td>
<td>8.67%</td>
<td>4.75%</td>
<td></td>
</tr>
<tr>
<td>OS 9</td>
<td>333</td>
<td>56.63%</td>
<td>31%</td>
<td></td>
</tr>
<tr>
<td>OS X</td>
<td>190</td>
<td>32.31%</td>
<td>17.69%</td>
<td></td>
</tr>
<tr>
<td>Windows 95</td>
<td>7</td>
<td>1.44%</td>
<td>.65%</td>
<td></td>
</tr>
<tr>
<td>Windows 98</td>
<td>106</td>
<td>21.81%</td>
<td>9.86%</td>
<td></td>
</tr>
<tr>
<td>Windows 2000</td>
<td>139</td>
<td>28.6%</td>
<td>12.94%</td>
<td></td>
</tr>
<tr>
<td>Windows ME</td>
<td>4</td>
<td>.82%</td>
<td>.37%</td>
<td></td>
</tr>
<tr>
<td>Windows NT</td>
<td>147</td>
<td>30.24%</td>
<td>13.69%</td>
<td></td>
</tr>
<tr>
<td>Windows XP</td>
<td>95</td>
<td>19.54%</td>
<td>8.84%</td>
<td></td>
</tr>
</tbody>
</table>

Other Names Listed: Unix, SCO, Unix(3 computers), Creo Brisque (2 computers), Linux, Solaris

Table 10. Number and Percentage of Computers with the following Operating System

Item 11 asked specifically about drawing software used by the printing and publishing industry. The question asked the respondent to identify the number of computers that have each drawing software installed on them and the percentage of files that use that software during a 2-week period. Of all the possible software responses possible for this question, Adobe Illustrator stood out as the most installed software and most used software in the drawing software category by the printing and publishing industry by being installed on almost 50 percent of all computers. The responses to Item 11 are summarized and reported below in Table 11.

As shown on the table below, there is a tendency for more Macintosh computers to be loaded with a particular drawing software compared to an IBM computer being loaded with the same drawing software. One example from table twelve below shows that 78.06% of Macintosh computers were loaded with the drawing software Adobe Illustrator versus 15.63% of PC computers.
<table>
<thead>
<tr>
<th></th>
<th>Adobe Illustrator</th>
<th>Macromedia Freehand</th>
<th>Corel Draw</th>
<th>Other Softwareabc</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Macs</td>
<td>459</td>
<td>180</td>
<td>8</td>
<td>47</td>
</tr>
<tr>
<td>% of Macs</td>
<td>78.06%</td>
<td>30.61%</td>
<td>1.36%</td>
<td>7.99%</td>
</tr>
<tr>
<td># of PCs</td>
<td>76</td>
<td>26</td>
<td>41</td>
<td>5</td>
</tr>
<tr>
<td>% of PCs</td>
<td>15.63%</td>
<td>5.35%</td>
<td>8.43%</td>
<td>1.03%</td>
</tr>
<tr>
<td># of Macs &amp; PCs</td>
<td>535</td>
<td>206</td>
<td>49</td>
<td>52</td>
</tr>
<tr>
<td>% of Macs &amp; PCs</td>
<td>49.81%</td>
<td>19.18%</td>
<td>4.36%</td>
<td>4.84%</td>
</tr>
<tr>
<td>% of files using</td>
<td>57.65% **</td>
<td>2.13% **</td>
<td>1.21% **</td>
<td>6.20% **</td>
</tr>
</tbody>
</table>

* Other Software: Quark, EPS files, PageMaker, Photoshop
** Not all respondents answered this portion of the question or their percentages did not total 100% so the total percentages in the table can not equal 100%

Table 11. Drawing Software and Usage

Besides drawing software, respondents were asked the same type of question, in Item 12, about image editing or image manipulation software that they use in the printing and publishing industry. The respondents were asked to identify the percentage of files that use that software over a two week period and the number of PC and Mac computers on which that software was installed. Table 12 summarizes these responses. Adobe Photoshop is the most used and installed software for any printing project that requires image editing/manipulation. Again the chart shows that the Macintosh computer is being used more than the PC for this software as approximately 81 percent of Macintosh computers have Adobe Photoshop installed on them versus 24 percent of PC computers.
<table>
<thead>
<tr>
<th># of Macs</th>
<th>Adobe Photoshop</th>
<th>Corel Painter</th>
<th>Inkscape</th>
<th>Quark/Adobe Impact</th>
<th>Nexus/Adobe Fireworks</th>
<th>Corel Painter</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>466</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>% of Macs</td>
<td>80.95%</td>
<td>.34%</td>
<td>0%</td>
<td>.17%</td>
<td>0%</td>
<td>0%</td>
<td>2.72%</td>
</tr>
<tr>
<td># of PCs</td>
<td>117</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>% of PCs</td>
<td>24.07%</td>
<td>3.50%</td>
<td>0%</td>
<td>0%</td>
<td>.21%</td>
<td>1.65%</td>
<td>1.44%</td>
</tr>
<tr>
<td># of PCs &amp; Macs</td>
<td>643</td>
<td>19</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>% of PC &amp; Macs</td>
<td>59.87%</td>
<td>1.77%</td>
<td>0%</td>
<td>.09%</td>
<td>.09%</td>
<td>.74%</td>
<td>2.14%</td>
</tr>
<tr>
<td>% of files using</td>
<td>78.59%</td>
<td>**</td>
<td>.5% **</td>
<td>0 **</td>
<td>.015% **</td>
<td>.0076% **</td>
<td>5.15%</td>
</tr>
</tbody>
</table>

*Other Software: DPM Scanmaster, ESKO Graphics, Fast Impose, Nexus Edit – CT/LW Trapping, PDF, iPhoto

** Not all respondents answered this portion of the question or their percentages did not total 100% so the total percentages in the table cannot equal 100%.

Table 12. Image Editing/Manipulation Software and Usage

Item 13 asked respondents to identify page layout software in use and the percentage of files that use that software in a two week period. QuarkXPress was the most popular choice and the most used by the respondents of this survey with the software installed on 476 Macintosh computers, 97 PC computers and almost 72% of all files that came through in a two week period used QuarkXPress. Table 13 shows the summary of the responses.
<table>
<thead>
<tr>
<th></th>
<th>QuarkXPress</th>
<th>Adobe InDesign</th>
<th>Adobe PageMaker</th>
<th>Adobe Framemaker</th>
<th>Corel Ventura</th>
<th>Other*</th>
</tr>
</thead>
<tbody>
<tr>
<td># of Macs</td>
<td>476</td>
<td>153</td>
<td>224</td>
<td>16</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>% of Macs</td>
<td>80.95%</td>
<td>26.02%</td>
<td>38.10%</td>
<td>2.72%</td>
<td>.68%</td>
<td>.85%</td>
</tr>
<tr>
<td># of PCs</td>
<td>97</td>
<td>24</td>
<td>79</td>
<td>18</td>
<td>3</td>
<td>9</td>
</tr>
<tr>
<td>% of PCs</td>
<td>19.09%</td>
<td>4.94%</td>
<td>16.26%</td>
<td>3.7%</td>
<td>.62%</td>
<td>1.85%</td>
</tr>
<tr>
<td># of PCs &amp; Macs</td>
<td>573</td>
<td>177</td>
<td>303</td>
<td>34</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>% of PCs &amp; Macs</td>
<td>53.35%</td>
<td>16.48%</td>
<td>28.21%</td>
<td>3.17%</td>
<td>.65%</td>
<td>1.3%</td>
</tr>
<tr>
<td>% of files using</td>
<td>71.77%</td>
<td>5.06%</td>
<td>6.27%**</td>
<td>.73%**</td>
<td>.18%**</td>
<td>4.24%</td>
</tr>
</tbody>
</table>

*Other Software: Microsoft Products, Publisher, PDF – Acrobat, PDF, Barco by Esko Graphics, Esko Graphics – Fast Impose ** Not all respondents answered this portion of the question or their percentages did not total 100% so the total percentages in the table can not equal 100%

Table 12. Page Layout Software and Usage

Data Comparison with Computer Hardware and Software

Throughout this section a comparison will be made between different sets of data from the demographic section of the survey and the data sets from the computer hardware and software section. These comparisons were made to identify possible trends or correlation between data sets. The first comparison that will be made will compare the size of the company and the number of computers that the company has in its prepress department. This will be reported in Figure 1 below. The company size is based upon the number of employees at the company. The data was combined into five different categories: 25 or less, 26-50, 51-100, 101-500 and 501 or more. The number of computers were added up and divided by the number of companies in that category to find out the average or mean number of computers per company. The results show that
there is a positive correlation ($r=0.936779$) between the number of employees at a company and the number of computers in their prepress department with the greatest jump coming from the 51-100 employees to the 101-500 employees category.

![Chart showing average number of computers in the prepress department by number of employees.](chart)

Figure 1: Number of Employees vs. Number of Computers in the Prepress Department

The second comparison that was made shows the percentage of total computers that are either Macintosh or PC versus the size of the company. This comparison was done by grouping together company size figures in the data to form five groups: 25 or less, 26–50, 51–100, 101–500 and 501 or more employees as was done for chart one. Then each company’s average of Mac and PC computers was computed. These figures were then added up and divided by the number of companies in that category to achieve the percentage of computers that were either Mac or PC. The results are shown in Figure 2.
Figure 2: Number of Employees vs. the Percentage of Mac and PC Computers

Figure 2 shows that smaller companies tended to use a higher number of Macintosh computers compared to the number of PC computers. As the number of employees reached 100 the difference in the number of Macintosh computers compared to the number of PC computers starts to even out with companies above 501 employees being almost even between the number of Macintosh computers and the number of PC computers.

The third comparison that was made between different data sets compared the number of total computers with the percentage of files submitted digitally. The data comparison, in Figure 3, shows that a large percentage of files are being submitted digitally no matter how many computers a company has. The correlation coefficient, for
this data set, was \( r = 0.24 \) which means there was very little relationship between the number of computers and the percentage of files submitted digitally.

Figure 3: Number of Computers vs. Percentage of Files Submitted Digitally

The next comparison of data collected from the survey of printing and publishing companies makes a similar comparison to that of Figure 3, but Figure 4 compares the overall size of the company to the average of the percentage of files submitted to the company. The figure shows that the two largest categories of companies and companies with 26 to 50 employees have more files submitted digitally and that the smallest category of companies, 25 or fewer employees, have the smallest percentage of files submitted digitally. Though it is the smallest representation in the chart it is very important to note that they still have an average of 78.82% of all of their files submitted digitally which means the computer is very prevalent in this part of the printing and
publishing industry. The correlation coefficient for the data comparison in Figure 4 was calculated at $r = 0.736837$ which shows a positive correlation between the percentage of files submitted digitally and the number of employees at a company.

Figure 4: Number of Employees vs. Percentage of Files Submitted Digitally

While it was important to examine how customer files were submitted to printing companies, it was also very pertinent to look at how the printing and publishing companies were processing the files. The computer was being used more often in this portion of the printing process. The next two figures illustrate the percentage of files sent to press by computer-to-plate technology or digitally versus the number of computers and to the size of the company based upon the number of total employees. Figure 5 shows that there is very little correlation ($r = 0.23$) between the number of computers and the percentage of files that are sent to press using computer-to-plate technology or digitally.
Figure 5 also shows that a larger portion of the companies that responded are sending more than 50 percent of their files to press using computer-to-plate technology. This shows that the use of computer-to-plate technology is very prevalent in the printing and publishing industry compared to using the older traditional method of shooting negatives, stripping films and burning plates.

Figure 5: Number of Computers vs. Percentage of Files Sent to Press by Computer-to-plate

Figure 6 also illustrates the percentage of files sent to press using computer-to-plate technology or digitally, but this figure compares the overall percentage for a category determined by the number of employees at the company. This figure shows any differences in the percentage of files sent to press using computer-to-plate technology based upon company size. The correlation coefficient was calculated $r=0.618648$ showing some correlation between the two data sets. The largest average percentage of
files sent to press using computer-to-plate technology was reported by the companies that had 101 to 500 employees and the second largest average percentage of files sent to press by computer-to-plate was reported by the 26 to 50 employee category. The smallest average percentage of files sent to press using computer-to-plate technology was reported by the smallest category of companies, this category had 25 or less employees.

![Graph showing the percentage of files sent to press by company size](image)

Figure 6: Number of Employees vs. Percentage of Files Sent to Press by Computer-to-plate

Figure 7 compares the percentage of files submitted digitally versus the percentage of files sent to press using computer-to-plate technology to find out if there is any correlation between the two. As the computer becomes more and more prevalent in this portion of the printing and publishing industry one might think that the use of the computer for submission of files might drive the company to use computer-to-plate technology or vice versa. Figure 7 shows that there is a very small correlation, r=0.19319,
between the two data sets which shows that the percentage of files submitted digitally does not drive the amount of files sent to press using computer-to-plate or vice versa.

![Percentage of Files Submitted Digitally vs. Percentage of Files sent to Press by Computer-to-plate or Digitally](image)

Figure 7: Percentage of Files Submitted Digitally vs. Percentage of Files sent to Press by Computer-to-plate or Digitally

From much of the data obtained from the respondents the computer is shown to be a very prevalent part of the prepress portion of the printing and publishing industry. In chapter five a summary of the data will be made, along with conclusions from the study and recommendations.
Chapter Five

Chapter five will include a summary of the research, conclusions about the data that was obtained from the research and recommendations on future research in the area of computer hardware and software used by the printing and publishing industry. The chapter will start by looking at a summary of the research that was conducted.

Summary of the Research

The research for this project began in the summer of 2002 with the research defining the statement of the problem: given the need to upgrade and purchase new hardware and software, Graphic Communications instructors don't know what computer hardware and software is currently in use by the printing and publishing. From the problem statement the list of questions below were developed and were to be answered by the descriptive research study:

1. What computer operating systems, including versions, are being used by businesses in the Graphic Communications and Printing industry in the State of Wisconsin?

2. What drawing programs are being used by businesses in the Graphic Communications and Printing industry in Wisconsin?

3. What photo editing/image manipulation programs are being used by businesses in the Graphic Communications and Printing industry in Wisconsin?

4. What page-layout programs are being used by businesses in the Graphic Communications and Printing industry in Wisconsin?

5. What percentages of printing jobs are submitted in conventional format (layouts, films, or plates) vs. digital format (computer files)?
6. What percentage of computer files are submitted in application files (layout applications) vs. PDF files or other software?

7. What are the differences in computer hardware and software used, based on demographics?

Conclusions

The first research question asked: What computer operating systems, including versions, are being used by businesses in the Graphic Communications and Printing industry in the State of Wisconsin? The data from the research found that when using a Macintosh computer the most used operating system was OS 9 with 56.63% of computers using this version. The second most used operating system on the Macintosh was OS X at 31.31%. An important note in regards to OS X is that when the survey of the population was completed, OS X was a relatively new operating system released by Apple meaning its use could be much greater today. The third operating system used was OS 8 with 8.67% of Macintosh computers using it.

If PC computers were being used, the most used operating system was Windows NT with 30.24% of all PC computers running this system. Windows 2000 was the second most used operating system on a PC system, with 28.6% of PC computers running this operating system. The following operating systems were also used and are listed from highest percentage of usage to the smallest percentage of usage on PC computers: Windows 98 – 21.81%, Windows XP - 19.54%, Windows 95 – 1.44% and Windows ME at .82%.

Apple’s OS 9 was the most used operating system when calculating the percentage of usage from all computers, both Macintosh and PC, with 31% of all
computers running this operating system. The second most popular operating system was OS 10 with 17.69% and the third most popular operating system was Windows NT with 13.69%.

When adding up the percentage of all operating systems used, the Macintosh operating systems are used more than the PC operating systems. 53.44% of all computers from the survey population are running a Macintosh operating system. This shows that the Macintosh does have a slight lead in the computer market in the printing and publishing industry.

Research question two asked: What drawing programs, including versions, are being used by the Graphic Communications and Printing industry in Wisconsin? The research found that Adobe Illustrator was the frontrunner in the drawing software category. 78% of Macintosh computers and 15% of PC computers had Adobe Illustrator installed on them and a total 49.81% of all computers (both PC and Macintosh) had Adobe Illustrator installed. The second most frequently installed software in the drawing category was: Macromedia Freehand with 30.61% of Macintosh computers having it installed on them and 5.35% of PC computers having Macromedia Freehand installed on them. The percentage of all computers (both PC and Macintosh) that had Macromedia Freehand installed on them was 19.18%. These numbers show that Adobe Illustrator is the most popular and most commonly used software in the drawing software category by a large amount.

Research question three asked: What photo editing/image manipulation programs, including versions, are being used by businesses in the Graphic Communications and Printing industry in Wisconsin? Adobe Photoshop was by far the dominant photo
editing/image manipulation software used by the population surveyed for this research. 80.95% of Macintosh computers had Adobe Photoshop installed on them and 24.07% of PC Computers. Of all computers Adobe Photoshop was installed on 59.87% of them. These statistics show that Adobe Photoshop is the industry standard software when it comes to photo editing/image manipulation software. The second most installed photo editing/image manipulation software was Corel PhotoPaint with 1.77% of all computers having it installed on them. This percentage is minute compared to the percentage of computers with Adobe Photoshop installed.

The fourth research questions asked: What page-layout programs, including versions, are being used by businesses in the Graphic Communications and Printing industry of Wisconsin? In this category QuarkXPress was the leading page-layout software. 53.35% of all computers had QuarkXPress installed on them and 80.95% of all Macintosh computers had QuarkXPress installed on them showing that QuarkXPress is the industry standard software. The second most installed software was Adobe PageMaker, which was installed on 28.21% of all computers, 38.10% of all Macintosh computers and 16.26% of all PC computers. The third most installed software is also produced by Adobe which is InDesign. InDesign is a higher end program built off of PageMaker by Adobe Systems. InDesign was installed on 16.48% of all computers, 26.02 of all Macintosh computers and 4.94% of PC computers. As InDesign continues to replace PageMaker, the use of InDesign may rise in the printing and publishing industry.

Research question five asked: What percentages of printing jobs are submitted in conventional format (layouts, films, or plates) vs. digital format (computer files)? The research found that the average percentage of files submitted through the conventional
method was 6.83% and the percentage of files submitted through the digital method was 90.54%. It is also important to note that the range for the percentage of files submitted using the conventional method was 0% - 50%. This shows that no matter what company was surveyed, no more than 50% of those company's files are submitted using the conventional method. This shows that the computer and digital files are the preferred and most used method of file submission in the printing and publishing industry.

Research question six asked: What percentage of computer files are submitted in application files (layout applications) vs. PDF files or other software? It was found that application files (layout applications) are the predominately used form of digital file when sending files to the printer with 65.57% of all files being submitted using an application file. PDF files were only used 28.69% of the time showing that the use of PDF files in file submission is only about half that of application files. Application files are overwhelmingly the choice by many in the printing and publishing industry.

The seventh and final research question asked: What are the differences in computer hardware and software used, based upon demographics? The first comparison that was made between two different sets was between the number of employees at the company and the number of computers in the prepress department. A positive correlation of r=0.936779 was found between these two sets of data. This shows a very high correlation between the size of the company and the number of computers in their prepress department.

The comparison of computers to the number of employees was broken down even further to find out if there was a difference between company size and the type of computer, either PC or Macintosh, companies preferred. It was found that smaller
companies, 100 employees or less, had a much larger percentage of Macintosh computers versus PC computers. Once the company size exceeded 501 employees, the percentage of Macintosh computers versus PC computers was almost equal. This statistic shows that smaller companies tend to prefer Macintosh computers over PC computers. It is important to note, that this statistic may be misleading due to the fact that the larger companies may have more PC computers that are used for general office work (administrative stations) and for servers on their network, compared to smaller companies that may have a small number of workstation computers used just for prepress work and very few administrative computer stations.

The second area of data comparison that was completed, dealt with the area of file submission. The first data comparison, made in this area, was a comparison between the percentage of files submitted digitally versus the number of computers at a company. This comparison found that there was a very correlation (r=.24) between the number of computers at a company and the percentage of files submitted to the company digitally. Also, looking at the data in the scatter plot (Figure 3) shows a large percentage of the data points on the figure to above 80% when looking at the percentage of files submitted digitally. This data shows that no matter the number of computers at a company most files are being submitted to the company in a digital format. This data also shows the importance of the computer in the prepress portion of the printing and publishing industry.

The second data comparison made in regards to file submission was a comparison between the percentages of files submitted digitally versus the number of employees at a company. A correlation coefficient was calculated for this data comparison which came
to $r = 0.737$, showing a positive correlation between the size of the company and the % of files submitted digitally. The group with the least amount of employees (25 or less) had the smallest percentage of files submitted digitally, 78.82%. It is important to note that if this is the smallest percentage of files submitted to the printer digitally, the computer is very prevalent in this portion of the prepress process. These two data comparisons show that no matter the size of the company or the number of computers at a company, a majority of files are submitted to the printer in a digital format.

The third area of data comparison was that was completed was done based upon how the file to be printed is going from the computer (design and page layout stage) to the printing press to be printed. The first comparison in this area was made between the number of Macintosh and PC computers and the percentage of files sent to press by computer-to-plate technology. When these two comparisons were made between each other a scatter plot (Figure 5) was created and a correlation coefficient was calculated for the two data sets, the correlation coefficient was $r = 0.23$ showing no or very little correlation between the number of computers and percentage of files sent to press using computer-to-plate technology. This shows that the number of computers at a company does not influence the use of computer-to-plate technology when going to press.

A comparison was also made between the percentage of files sent to press using computer-to-plate or digitally and the number of employees at a company. The correlation coefficient was $r = 0.61$, showing some correlation in this comparison. This shows that the larger companies are a bit more likely to be using computer-to-plate technology compared to smaller companies.
The final comparison made with the use of computer-to-plate technology was with the percentage of files being submitted digitally. The data comparison showed very little or no correlation ($r = 0.19$) between the percentage of files submitted digitally and the percentage of files sent to press by computer-to-plate technology. With all three data comparisons the only factor that may show an increase in the use of computer-to-plate technology would be the size of the company based upon the total number of employees. With larger companies, they may have more money to spend on piloting and implementing newer technology sooner than smaller companies who may not be able to afford the newest technology on the market.

Recommendations:

Upon completion of this study the following recommendations have been made for anyone completing research into the area of computer hardware and software used in the printing and publishing industry based upon findings and input from this research process.

1. When surveying the population a distinction should be made between a workstation computer and an administrative computer. A workstation computer being one that is used directly for the prepress process and an administrative computer being one that is used for administrative tasks by other employees or as a server(s) for the prepress department and/or the companies network. This would allow for a more accurate picture of the number and type of computers used in the prepress portion of the printing and publishing industry.
2. More research needs to be done on the usage of computer-to-plate technology in the future. This is an emerging technology in the printing and publishing industry and the usage of this technology will change as the printing and publishing industry changes.

3. The inclusion of versions of software on the survey instrument to find out if a particular version of that software is being used. Furthermore, a question in regards to why they are using that version may help understand the particular version used.

4. More research needs to be completed in the area of digital printing. Digital printing is one of the newer technologies being used in the printing and publishing industry. One or two respondents mentioned this on their survey.

5. A larger population should be surveyed to increase the validity of the study.

6. The research should be completed on a regular basis as new technologies are emerging and being used more often by the printing and publishing industry.
References


Appendix A:
1st Sending – Cover Letter
Dear Printing Industry Professional:

My name is Timothy Harder and I am a graduate student at the University of Wisconsin-Stout working on my Master’s Degree in Technology Education. For my masters thesis I am trying to identify what computer hardware and software is being used by the printing industry in the State of Wisconsin. The information from this survey will benefit Graphic Arts Educators around the state by allowing them access to statistical data on what current technology is being used in the area of computer hardware and software by the printing industry in the State of Wisconsin.

This survey is being sent to randomly selected members of Printing Industries of Wisconsin to identify what computer operating systems and software are being used in the following categories: drawing, editing/image manipulation, and page layout. The results of this study will create a knowledge base of statistics for Graphics instructors to validate the purchase of new computers and software for their programs. By taking a few minutes of your time to fill out this survey, you are helping Graphic’s instructors update their computer labs to reflect the current status of the printing industry in Wisconsin.

Your participation in this study is completely voluntary but very important because not all members of Printing Industries of Wisconsin will receive surveys. If you are not the appropriate person to complete the survey, would you please forward it to the appropriate person. The answers you provide will be kept confidential. All answers will be tabulated and presented in a summarized fashion so no one can identify any individual’s response. The numbers written on your respective survey are for the purpose of tracking who has returned the survey so follow-up surveys may be sent out at a later date to those who did not return a survey.

I would like to thank you in advance for taking the time to fill out this survey. Please place the completed survey in the pre-paid return envelope and place in the mail before January 14, 2004. If you have any questions about the survey or would like to know the results of the survey please e-mail me at hardert@new.uwstout.edu.

Thank you again for your time in completing the survey,

Tim Harder

Consent: I understand that by returning the this questionnaire, I am giving my informed consent as a participating volunteer of this study. I understand the basic nature of the study and agree that any potential risks are exceedingly small. I also understand the potential benefits that might be realized from the successful completion of this study. I am aware that the information is being sought in a specific manner so that only minimal identifiers are necessary and so that confidentiality is guaranteed. I realize that I have the right to refuse to participate and that my right to withdraw from participation at any time during the study will be respected with no coercion or prejudice. Questions or concerns about the study should be addressed to Tim Harder (920) 364-9862, the researcher, or Ynd Benson (715) 232-1294, the research advisor. Questions about the rights of research subjects can be addressed to Sue Foschini, Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research, 11 Harvey Hall, Menomonie, WI 54751, phone (715) 232-1126.
Appendix B:
1st Survey Sent
Directions: Please answer each question to the best of your knowledge. Please circle the appropriate answer from the answers listed below for each question (Some questions allow for multiple answers). If you choose the other category for a question or the question asks for a written answer please write your answer in the space provided.

1. Approximately how many people work for the company you are employed by?
   A. 5 or less     D. 16-20     G. 31-40     J. 61-80     M. 251-500
   B. 6-10         E. 21-25     H. 41-50     K. 81-100    N. 501-1000
   C. 11-15        F. 26-30     I. 51-60     L. 101-250   O. 1001 or more

2. Approximately how many people work in the pre-press department(s)?
   A. 1          D. 6-10      G. 31-40      J. 71-90
   B. 2-3        E. 11-20     H. 41-50      K. 91-110
   C. 4-5        F. 21-30     I. 51-70      L. 111 or more

3. Which of the following categories best represents the business you work for?
   A. Commercial Printer         D. In-Plant Printing     G. Package Printing
   B. Trade Shop                 E. Catalog/Publications   H. Label Printing
   C. Quick Print Shop           F. Book Printing          I. Other: ___________________________

4. What is your current Job title? ________________________________

5. What department do you work in? _______________________________

6. What percentage of incoming work is submitted by the customer in a conventional format (layouts, films or plates) vs. a digital format (computer files)?
   Conventional ________%   Digital ________%

7. Of the digital files you receive from your customers, what percentage of these files are submitted in application files (layout applications) vs. PDF files or other software?
   Application files ________%   PDF files ________%
   Other Software ________%     Software Name: __________________________
8. What percentage of your files are sent to press by traditional methods (shooting negatives, stripping flats, and burning plates) of plate creation vs. using computer-to-plate technology?

Traditional _____%  Computer-to-plate _____%

9. How many of each type of computer do you have in your department?

Macintosh ___________  PC(IBM Compatible) ___________

10. Please list the number of computers in your department that use the operating system(s) shown below.

<table>
<thead>
<tr>
<th>Macintosh:</th>
<th>IBM Compatible:</th>
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<tbody>
<tr>
<td>A. OS 8</td>
<td>E. Windows 95</td>
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<td>B. OS 9</td>
<td>F. Windows 98</td>
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<tr>
<td>C. OS X</td>
<td>G. Windows 2000</td>
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<tr>
<td>D. Other</td>
<td>H. Windows ME</td>
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<td>(please describe)</td>
<td>I. Windows NT</td>
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<td></td>
<td>J. Windows XP</td>
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</table>

11. Please list how many computers have the drawing software (listed below) installed on them, and the approximate percentage of files that come through your department during a 2 week period that use the software.

<table>
<thead>
<tr>
<th>Software</th>
<th>Mac</th>
<th>PC</th>
<th>% of Files</th>
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<tr>
<td>A. Adobe Illustrator</td>
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<td>B. Macromedia FreeHand</td>
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<td>C. CorelDraw!</td>
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<td>D. Other</td>
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</table>

***Survey Questions Continued on the***

Back of This Page
12. Please list how many computers have the editing/image manipulation software, listed below, installed on them and the approximate percentage of files that come through your department over a 2 week period that use that software.

<table>
<thead>
<tr>
<th></th>
<th>Mac</th>
<th>PC</th>
<th>% of Files (Total Should =100%)</th>
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<td>A.</td>
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<td>Adobe Photoshop</td>
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<td>B.</td>
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<td>Corel PhotoPaint</td>
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<td>C.</td>
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<td>JASC Paint Shop Pro</td>
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<td>Other</td>
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13. Please list how many computers have the page layout software, listed below, installed on them and the approximate percentage of files that come through your department over a 2 week period that use that software.

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<thead>
<tr>
<th></th>
<th>Mac</th>
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<th>% of Files (Total Should =100%)</th>
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<td>A.</td>
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<td>QuarkXPress</td>
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<td>B.</td>
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<td>Adobe Indesign</td>
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<td>Adobe Pagemaker</td>
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<td>Adobe Framemaker</td>
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<td>Corel Ventura</td>
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<td>F.</td>
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<td>Other</td>
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Thank you again for taking the time to fill out this survey. Please place the completed survey in the return envelope and mail by January 14, 2004.
Appendix C:
2nd Sending – Cover Letter
Dear Printing Industry Professional:

Approximately two weeks ago you should have received a survey about computer hardware and software used by the printing and publishing industry in the State of Wisconsin. As of now I have not received your survey. This survey is very important as it will give a good knowledge base for high school graphic arts instructors to base equipment purchases and their curriculum on when it comes to computer hardware and software.

You have been randomly selected so not every member of Printing Industries of Wisconsin will get a survey, which makes your response even more important to help complete this study. I have included a second copy of the survey incase you have misplaced yours. If you have already completed and returned this survey or your business does not pertain to the study being conducted, please note that on the survey and return it to me. Please remember that your answers are completely confidential and answers will be summarized so you will not be able to be identified.

Your survey has again been numbered so that duplicate surveys will not be included in this study. I would again like to thank you for your cooperation and taking the time to fill out this survey accurately. Please place your completed survey in the return envelope by February 6, 2004 so your valuable information can be included in the study. If you have any questions about the survey or would like the results of this study, please e-mail me at hardert@coost.uw-stout.edu.

Thank you again for your time in completing the survey and helping out Graphic Arts instructors.

Tim Harder

Consent: I understand that by returning this questionnaire, I am giving my informed consent as a participating volunteer of this study. I understand the basic nature of the study and agree that any potential risks are exceedingly small. I also understand the potential benefits that might be realized from the successful completion of this study. I am aware that the information is being sought in a specific manner so that only minimal identifiers are necessary and so that confidentiality is guaranteed. I realize that I have the right to refuse to participate and that my right to withdraw from participation at any time during the study will be respected with no coercion or prejudice.

Note: Questions or concerns about the study should be addressed to Tim Harder (920) 361-9862, the researcher, or Ted Jensen (715) 232-1294, the research advisor. Questions about the rights of research subjects can be addressed to Sue Foxwell, Human Protections Administrator, UW-Stout Institutional Review Board for the Protection of Human Subjects in Research, 11 Harvey Hall, Menomonie, WI, 54751, phone (715) 232-1126.
Appendix D:
2nd Survey Sent
Directions: Please answer each question to the best of your knowledge. Please circle the appropriate answer from the answers listed below for each question (Some questions allow for multiple answers). If you choose the other category for a question or the question asks for a written answer please write your answer in the space provided.

1. Approximately how many people work for the company you are employed by?
   D. 5 or less  D. 16-20  G. 31-40  J. 61-80  M. 251-500
   E. 6-10  E. 21-25  H. 41-50  K. 81-100  N. 501-1000
   F. 11-15  F. 26-30  I. 51-60  L. 101-250  O. 1001 or more

2. Approximately how many people work in the pre-press department(s)?
   D. 1  D. 6-10  G. 31-40  J. 71-90
   E. 2-3  E. 11-20  H. 41-50  K. 91-110
   F. 4-5  F. 21-30  I. 51-70  L. 111 or more

3. Which of the following categories best represents the business you work for?
   D. Commercial Printer  D. In-Plant Printing  G. Package Printing
   E. Trade Shop  E. Catalog/Publications  H. Label Printing
   F. Quick Print Shop  F. Book Printing  I. Other:

4. What is your current title? ____________________

5. What department do you work in? ____________________

6. What percentage of incoming work is submitted by the customer in a conventional format (layouts, films or plates) vs. a digital format (computer files)?

   Conventional _____%  Digital _____%

7. Of the digital files you receive from your customers, what percentage of these files are submitted in application files (layout applications) vs. PDF files or other software?

   Application files _____%  PDF files _____%
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8. What percentage of your files are sent to press by traditional methods (shooting negatives, stripping flats, and burning plates) of plate creation vs. using computer-to-plate technology?

Traditional _______%  Computer-to-plate _______%

9. How many of each type of computer do you have in your department?

Macintosh ____________  PC(IBM Compatible) ____________

10. Please list the number of computers in your department that use the operating system(s) shown below.

Macintosh:  
D. OS 8 ______  E. Windows 95 ______  
E. OS 9 ______  F. Windows 98 ______  
F. OS X ______  G. Windows 2000 ______  
H. Windows ME ______  
D. Other (please describe) ______  I. Windows NT ______
J. Windows XP ______

IBM Compatible:  
E. Windows 95 ______  
F. Windows 98 ______  
G. Windows 2000 ______  
H. Windows ME ______  
I. Windows NT ______  
J. Windows XP ______

11. Please list how many computers have the drawing software (listed below) installed on them, and the approximate percentage of files that come through your department during a 2 week period that use the software.

E. Adobe Illustrator ______  Mac ______  PC ______  % of Files ______
F. Macromedia FreeHand ______  ______ ______
G. CorelDraw! ______ __________
H. Other ______ ______ ______

***Survey Questions Continued on the***
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<td>H.</td>
<td>Adobe Photoshop</td>
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<td>H.</td>
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<td>L.</td>
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Thank you again for taking the time to fill out this survey. Please place the completed survey in the return envelope and mail by February 6, 2004.