Visual Communications
Journal 2002

Table of Contents

Visual Communications
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Acknowledgements

How We Produced the Journal

All articles were submitted electronically in the Microsoft Word format. All photographs were submitted digitally and were edited and converted to grayscale using Adobe Photoshop. Graphs and tables were created from Adobe Illustrator or QuarkXPress. Page design and layout, were accomplished using QuarkXPress. The file was converted to a press-optimized PDF which was then e-mailed to Western Wisconsin Technical College for imagesetting, platemaking, printing, and binding.

About the Journal

The Visual Communications Journal serves as the official journal of the International Graphic Arts Education Association, Inc., and provides a professional communicative link for educators and industry personnel associated with design, presentation, management, and reproduction of graphic forms of communication. Manuscripts submitted for publication are subject to peer review by the Association, and the views and opinions expressed herein are those of the authors and do not necessarily reflect the policy or views of the IGAEA.

Article Submission

Membership and Subscription Information

Information about membership in the Association or subscription to the Journal should be directed to IGAEA Second Vice-President.

Editor's Note

Congratulations to all the authors whose articles are being published in the 2002 *Visual Communications Journal.* I believe you will agree that they have done an excellent job of providing useful and timely information to others in the profession.

With the exception of student articles, all of the manuscripts are blind reviewed by a jury of graphic communications professors. Based on the jury response, the accepted articles are designated as edited, juried, or refereed. In the case of student articles, the editor makes a decision on acceptance.

The 2002 Articles

The first article in the 2002 *Visual Communications Journal*, by Penny Osmond at California Polytechnic State University and Jerry McMurtry at the University of Idaho, provides an overview of research which was conducted to compare on-site and web-based delivery of industry training. Even though no significant differences were found, distinct advantages were found for each method. As this technology continues to advance, this issue certainly need to be revisited.

Chris Lantz from Western Illinois University shows how instructors can teach graphic production with free and open-source software. Instead of using lack of funds as an excuse for not teaching certain applications, he shows how software can be obtained with little or no funds. A wide variety of products are presented, and I suspect many will be new to you as they were for me.

One of the important aspects of the history of graphic communications is the origins of hypertext, and Bill Havice from Clemson University does a nice job of providing this foundation. He provides all the detail you will need for a nice lecture on this topic, or as an option, that students can access online, www.igaea.org.

Rita Dobbs, from The University of Texas at Tyler, provides a synopsis of her research on training educators to use interactive television and distance education. She compared concerns of educators who receive only classroom training on distance education with those who receive both classroom training and laboratory experiences. Her results indicate that the addition of laboratory experiences enhances the training considerably, and this supports previous research that shows that users of telecommunication systems greatly benefit from in-depth training.

A team of authors (Gillispie-Johnson, Dunn, Brown, and Childress) from North Carolina Agricultural and Technical State University provide a plan and rationale for a communication laboratory with a wide variety of telecommunication and instructional tools needed by students for basic understanding of this cutting-edge technology, and needed by instructors for delivering courses in a variety of distance and face-to-face formats. This should help others proposing such a laboratory.

I worked with my doctoral student, Mengtsung Tai, University of Northern Iowa, to develop a practical article on scanning basics. This is information that might be of help to instructors as they develop a lecture on this topic, or as assigned reading. By the way, in order to be fair to the other authors, this article was blind reviewed by the jurors also.

Jason Schmid, from Washington State University, provides the case for using student-produced film in the classroom. He believes that this provides students a depth of experience with topics not easily taught in other ways. This might provide you some new ideas for class assignments.

There are two student articles in this year's *Visual Communications Journal.* Jonathon Guy from Pennsylvania College of Technology discusses the advantages of using dual processing, which is found on the Apple Power Macintosh G4. Mengtsung Tai, from the University of Northern Iowa, provides a short overview of premedia, a term which he thinks may replace prepress in the future. Thanks to both of these students for submitting their articles for publication.

The People Who Made This Journal Possible

This year's jurors are Tom Gray, Z. A. Prust, and Dan Wilson, well known professors in the graphic communications field. I believe each of these people were actually too busy to assist with the review process, but helped out anyway because of their sense of professionalism. Thanks to each of you for your dedication and hard work.

I also need to thank the design and printing team for this year's journal. The design and layout, with the exception of the cover, was done by University of Northern Iowa students Mengtsung Tai, Wendy Loeffler, and Juli Camarin. In fact, I thought I should also give Mengtsung the title of Assistant

Editor for the many extra hours he spent on the journal. I simply could not have done this without their help. I was amazed to watch them work on the design, and pore through each article to assure consistent style.

Gene Van Roy, with the help of his students at Western Wisconsin Technical College, has printed most of the *Visual Communications Journals* since 1991, and has contributed untold hours to the International Graphic Arts Education Association. It becomes a family affair at crunch time and his wife Kathy and daughter Sarah help with manually collating the journal, as well as preparing the journal for mail out, which is a huge job. We owe each of these individuals a huge debt of gratitude.

Janet Oglesby is an instructor in the Electronic Imaging and Printing Program at Western Wisconsin Technical College and has also put in countless hours on the *Visual Communications Journal.* She is in the prepress area, and assisted this year with film output, as well as final journal assembly and mail out. Thanks for all your hard work Janet.

Speaking of Western Wisconsin Technical College, Paul Casper, a

first year Graphic Design student, is to be congratulated for designing the 2002 *Visual Communications Journal* cover. This is excellent work, and another fine example of the capabilities of our students.

As you can see, this journal is certainly a team effort, and I appreciate all that each person accomplished. I am deeply honored to be able to work with such a fine group of professionals. Thanks again for all your effort.

Charles D. Johnson, Editor
2002 *Visual Communications Journal*

Graphic Communication Industry Training: A Critical Comparison of Knowledge Gained and Satisfaction of Learners Between On-Site Delivery and Web-Based Delivery

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Introduction

There is a need for training in the graphic communication industry (Osmond, 1999). Companies that provide training to their employees are more likely to remain competitive. Technology has brought about change for the graphic communication industry and created more of a need for training. However, not all companies can afford to send their employees somewhere for outside training. Technology has enabled training within some industries to be conducted using the World Wide Web.

According to Schrieber & Berge (1998), there is an inherent dichotomy between organizational training and academic education. Education is a process of acquiring new knowledge typically through some type of school or university. Education is aimed at enriching and expanding the lives of individuals to enhance their role in socie-ty and within a profession. Schrieber also believes that a goal of education is to help individuals develop self-directed learning skills for continued personal growth.

Training addresses specific skills and knowledge that help improve job performance. Organizations need current knowledge and skills, but are also finding that lifelong learning is a necessity (Schrieber, 1998). With the increase in technology and consequently the short shelf-life of knowledge, it is important to encourage employees to develop self-directed learning skills to be competitive.

Senge (1990) and Buhler (1999) point out that today's emphasis should be on the learning organization. A learning organization focuses on employees becoming life-long learners. The development of the workforce, including life-long learning, is necessary to successfully compete in today's world.

According to Kouzes and Posner (1995), we are in a new global village in which we are all connected electronically, yet the world is more diverse and fragmented than ever before. They emphasize the reality that knowledge is the new currency. Competition is fierce. The digital revolution is upon us. Printing companies are facing the same issues as other technology-driven businesses. To stay competitive, they must invest in the technology and decrease the production cycle. As with all new technologies, the need for training is greater than ever. Even for the graphic communications industry, knowledge is becoming the new currency.

Educators are finding alternative ways to deliver education to students unable to attend the institution. Educators have experimented with many alternative forms of delivering education. Some of these forms of delivery have included correspondence using the U.S. Postal Service, radio, TV & video-tape delivery, video-conferencing, CD/DVD delivery, compressed-video and recently the World Wide Web. Research has been conducted on the effectiveness of distance learning in terms of student learning. Ferguson and Wijekumar (2000)

found that web-based instruction for safety professionals provided a convenient and quality learning environment for students. They concluded that students achieved "the true value of learning" and "were able to seek, analyze, synthesize and apply knowledge to real-life safety issues"(p. 32).

Graphic Communication Industry

There has always been a need for training in the graphic communication industry. The transition from analog data to digital data for graphic arts companies makes the training needs greater than ever. According to Wilken (2000), "The graphic arts industry also is a witness to the need for technical, marketing, and general business learning and training programs in order to stay abreast of changing technologies"(p.103). Wilkens assessed six major industry organizations that offer various types of training and found that none of them offered on-line training.

Training for the graphic communication industry has traditionally been delivered through on-site training, conferences, workshops, trade-shows and on-the-job-training. Recent technologies have provided training options through CD/DVD and tutorial textbooks specific to particular software. A few schools and companies are offering training in the graphic communication industry using web-delivery. Wilken (2000) mentions Rochester Institute of Technology and Arizona State University as two schools offering distance learning courses. However, very little is being done in the graphic communication industry in the area of web-based education or web-based training.

Effectiveness and Cost

It is important to conduct research regarding the effectiveness of training delivered using the World Wide Web compared to traditional training methods. There is a need for training in the graphic communication industry yet sending an employee to a seminar, conference or workshop is expensive. Not all companies can afford to provide this type of training for their employees. If web-training is as effective as traditional training methods it may provide a cost-effective alternative for training needed in many companies. It may give the companies the advantages they need to stay profitable and competitive.

Purpose

The purpose of this research was to study two different methods of delivering training, on-site and web-based, to employees in the graphic communication industry. The study measured and compared the knowledge gained between the two methods and also measured trainee satisfaction between the two methods.

Research Questions

This research addresses two questions specific to training in the graphic communication industry.

1. Is there a difference in knowledge gained between training offered on-site at a training center and training offered using a web-based method of delivery?
2. Is there a difference in trainee satisfaction between training offered on-site and training offered using web-delivery?

Methodology

Subjects

The population of interest for this study was employees working for companies belonging to Printing Industries of America, Southern California (PIASC), Printing Industries of Northern California (PINC) and employees working in San Luis Obispo County printing

companies. A group of 327 companies were randomly selected from PIASC and PINC membership lists and asked to voluntarily participate in the study. Convenience sampling was then conducted with San Luis Obispo County printing companies. Companies were allowed to have more than one employee participate in the training. A total of 16 companies agreed to participate with a total of 21 people agreeing to complete the study. Once the 21 participants were selected, they were randomly assigned to either the control group (on-site training) or the treatment group (web-based training).

Design

This study was an experimental design, specifically using a Pretest-Posttest Randomized-Groups Design. A quantitative questionnaire, The *Student Satisfaction Questionnaire* (SSS), was also used to measure learner satisfaction.

Training Curriculum

The Graphic Arts Technical Foundation (GATF) Imaging Skills Curriculum was used as the content delivered to both groups. The GATF curriculum is currently in the form of CD-ROM instruction. It is designed to be delivered by a face-to-face instructor. Knowledge gained was measured using the written exam included in the curriculum as a pretest and a posttest.

Instruments

Each group was given a comprehensive written pre-test from the *GATF Imaging Skills Training Program* at the beginning of the study. Training was then conducted for both groups. Upon completion of the training, each group was given the same comprehensive written exam as a post-test. The pretest/posttest used was from the Imaging Skills curriculum developed by GATF. The pretest/posttest was used as the instrument to measure the knowledge gained. The instrument is reliable for measuring knowledge since it is a standard instrument used in the industry to determine knowledge gained after completing the *GATF Imaging Skills Training Program*.

A quantitative survey was given measuring student satisfaction. The *Student Satisfaction Survey* (SSS) is an established questionnaire (Biner, 1993) slightly modified by the researcher to collect data reflecting the appropriate methods of delivery. Biner developed and used the SSS to measure learner satisfaction in televised courses. Terminology was changed to reflect the web-based delivery method rather than the televised delivery method. The same Likert scale was used on the SSS as was used in Biner's study. Since the SSS was originally designed for televised courses it can be considered reliable for measuring satisfaction specific to that method of delivery. Since it was slightly modified for this study, it cannot be considered completely reliable for web-delivered courses. It did, however, provide data for this study to be examined with regard to student satisfaction.

Procedures

Companies assigned to the control group were allowed to send one or more employees to the on-site workshop that was conducted over a one and a half-day period. A total of twelve employees completed the workshop representing seven companies.

Companies assigned to the treatment group were allowed to have one or more employees participate in the web-based workshop. This workshop was conducted over a four-week period to allow employees to continue working at their job. A total of nine employees completed the workshop representing eight companies.

The same instructor, who was also the researcher, taught both workshops. This served to control any bias in instruction between the two groups. Because the researcher was the instructor, this could potentially pose a threat by including a bias by the researcher towards good results. To control for this bias, the researcher did not promote or advocate one method of delivery over the other during the research to anyone involved in the study. The researcher tried to control any bias throughout the study in any form.

Conducting the Training

The curriculum used for both groups was the Graphic Arts Technical Foundation (GATF) Imaging Skills Curriculum. The curriculum consists of five modules representing the entire printing process. Since this study focused more on training specifically in the prepress area, only three of the five modules were presented to participants. The on-site training was conducted in a one and a half day time period. The web-based training was conducted in a four-week time period. The same material was covered in both groups.

The on-site participants received the information through the use of lectures, PowerPoint pre-

Table 1: Raw mean scores for difference between pretest and posttest		
Condition	n	Mean Score
On-site delivery	12	11.25
Web-based delivery	9	10.67

sentations and classroom discussion. Hands-on exercises were required and students were allowed to take self-study quizzes which reinforced the concepts taught. Once the training was completed each participant was given a posttest and a quantitative Student Satisfaction Survey.

The web-based participants received information through the use of e-learning software called Blackboard CourseInfo. Each participant also received a set of CD's made by GATF that were designed to instruct people taking the Imaging Skills Curriculum. The same questions that were asked in the classroom discussion for the on-site group were posted in the discussion board within Blackboard. Instructions were provided that included reviewing materials on the CD, taking self-study quiz assessments, participating in the discussion board questions and participating in the same hands-on exercises that were given

to the on-site group. Once the training was completed each participant was sent a posttest and quantitative Student Satisfaction Survey.

Results

Nonparametric statistical tools were used to determine if a significant difference existed between the group that received the on-site training and the group that received the web-based training. Analysis was done for both knowledge gained and satisfaction of the learner. An alpha level of 0.05 was used for all statistical tests.

Knowledge gained was measured by the difference in participant scores from the pretest to the posttest. The pretest/posttest used was from the standard Imaging Skills curriculum developed by GATF. The test score was from a possible 60 points. The differences between the pretest and posttest scores ranged from 1 to 33. A Kruskal-Wallis analysis was used to

Table 2: Raw mean scores for student satisfaction survey

Condition	n	Mean Score
On-site delivery	12	31.75
Web-based delivery	9	29.44

compare the mean scores to each other. The on-site group had twelve participants (n=12) while the web-based group had nine participants (n=9). The mean scores for the difference in participant scores from pretest to posttest between the on-site group and the

were compared between the on-site group and the web-based group. The mean scores for SSS between the on-site group and the web-based group were 31.75 and 29.44 respectively (see Table 2). A score of 24 would represent an overall satisfaction of *Average*, while a

Table 3: Test statistics for Kruskal-Wallis

Source	df	X^2	p
Difference between pretest and posttest	1	.046	.830
Student Satisfaction Survey	1	1.556	.212

p < .05

web-based group were 11.25 and 10.67 respectively (see Table 1).

Satisfaction was measured using a quantitative *Student Satisfaction Survey* (SSS) using a Likert Scale. A total score was generated from each questionnaire. Scores could range from 8 to 40. Mean scores

score of 32 would represent an overall satisfaction of *Good*. Both mean scores then are most comparable to an overall satisfaction of *Good*.

The analysis revealed that there was no statistical difference between the on-site group and the

web-based group in knowledge gained, X^2 (1, N=21)=.046, p=.830.(see Table 3).

A Kruskal-Wallis analysis was used to compare the mean scores to each other. The analysis revealed that there was no statistical difference between the on-site group and the web-based group in learner satisfaction, X^2 (1, N=21)=1.56, p=.212 (see Table 3).

Analysis and Discussion

This study addresses the question of whether web-based training can be a viable option in the graphic communications industry. As stated earlier, there was no significant difference between the web-based group and the on-site group for measurement of both knowledge gained and satisfaction of the learner.

A Kruskal-Wallis analysis was used for analysis of knowledge of learning gained for the on-site delivery (control group) compared to web-based-delivery (treatment group). It was also used for analysis of learner satisfaction between the two groups. The sample sizes for the control group and treatment group were twelve and nine respectively. The Kruskal-Wallis analysis was used because of the small group sizes. This particular analysis met the non-parametric assump-

tions required for use of the Kruskal-Wallis test.

In the study of adult education and training there are two schools of thought that should be considered when considering the impact of training on employees, the behaviorist and constructivist theories. The behaviorist theory focuses more on the observable behavior rather than the inner workings of the mind (Rich, 1971) while the nature of constructivism is based on a person's experiences and their ability to interact with and gain understanding of their experiences (Tobin, 1992). Employees working in a particular profession will have more of a need to know information that directly applies to their profession. A student in an educational environment may not have as much need to acquire the information. The experience is therefore less personal to a student seeking an education than it would be to an employee seeking training. Learning in a work environment may have advantages over learning in an educational setting (Berge, 1998).

Even though both groups in this research received information differently, both groups had the experience of applying the information to their current jobs. The hands-on component of the work-

shop further enabled learners to construct their own knowledge base. Since there was a need for both groups to acquire the knowledge and take that knowledge back to the job, there was a viable reason to acquire the knowledge. Therefore, the results of this study follow the constructivist's view of learning primarily because of the employee's abilities to construct knowledge based on their own reality as it related to their jobs.

The graphic communications industry is a very production and deadline oriented industry. Efficient production of printed material is essential to a company's survival. The need for training in the graphic communications industry is not in question. The question is how companies can provide the training needed in a cost-effective manner while maintaining the production deadlines needed for the company. Sending employees to another site could be costly and can impact productivity on their job. Bringing a trainer into the company could also be costly and could interfere with employee productivity. Self-directed learning strategies such as tutorial books, video tapes or CD / DVD's are good alternatives but require the employee to find the time and the self-motivation to

complete the training. Sometimes without an instructor or supervisor involved completion can be difficult. Although web-based training is not a cure-all for a company's training needs, it can fill a void in training were other methods may not work.

Conclusions
In conclusion, this study determined that there was no significant difference between web-based training and on-site training for both knowledge gained and satisfaction of the learner. If circumstances permit, most people would prefer to learn in a face-to-face environment with the ability to interact with instructor and students in the same room. When that is not an option, web-based training is a viable alternative to face-to-face learning.

Efficient production is a key to success within graphic communication companies. Training can help an employee become more efficient. However, finding the time to provide training is often a challenge. Taking time to train means taking time away from production. Cost can also be a deterrent for providing training. If cost and time were not an issue, most employers would probably prefer to send

their employees to a professional training facility, which is more flexible for working around a production deadline environment.

Unlike other self-directed training methods such as books, video or CD/DVD tutorials web-based training can offer the advantage of instructor and student interaction. Web-based training can offer on-line testing providing immediate feedback and assessment to the learner. Web-based content can also be updated more readily. Web delivery will not replace other methods of delivering training just as web-based newspapers and journals have not replaced traditional newspapers and journals. It is anticipated that technology will increase in both sophistication and quantity of users. As this occurs web-based training will become more readily available to companies.

It is recommended that further studies be conducted comparing the knowledge gained between students learning in a classroom and employees learning on the job. It is further recommended that studies be conducted comparing the cost of training for web-based training to on-site training.

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Dr. Penny Osmond is an Assistant Professor in the Graphic Communication Department at California Polytechnic State University. She teaches in the areas of electronic publishing, digital file preparation/assessment and consumer packaging. She has been teaching since 1987 and has experience in high school, community college, four-year college and university level teaching. Penny has a Ph.D. in Education from the University of Idaho in Moscow, Idaho. Her Master's degree is from University of Nevada, Las Vegas and Her Bachelor's degree is from Ferris State University in Big Rapids, Michigan. Her areas of expertise are in file creation and preparation for successful output, workflow and output issues and packaging prepress including including preparation for the flexographic printing process.

Dr. Jerry McMurtry is an Associate Professor in the Division of Adult, Counselor & Technology Education at the University of Idaho. He teaches undergraduate technology courses and graduate adult education and human resource development courses. His interest and research areas focus around the nature of adult learning in the workplace. He holds both bachelors and masters degrees in business and a Ph.D. in human resource development from Colorado State University.

Using Free and Open-Source Software to Teach Graphic Production

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Introduction

Free, open-source and trial versions of software titles have become effective alternatives to commercial software for many applications in the classroom. I have used free software to teach image editing, image correction, 3D modeling, vector drawing, and digital video. Free software can be a powerful solution if you don't mind experimenting and learning on your own. Free software can also enable you to teach classes and content thought impossible because of insufficient funds for software. There are many free programs in the field of graphic production and this paper details just some of them. I have tried to focus on those applications that are indispensable to me in everyday classroom instruction. In the sections that follow I have provided references to websites for program downloads, on-line documentation and references to the books and manuals that are available for this software.

Open-Source and GNU GPL Software

Open-source is the least restrictive type of free software and it is often termed *copylift* instead of *copywrite*. You are not only able to use such software for free but it can be copied and modified without restriction, other than returning any improvements to the public domain. Most open-source software uses the *GNU* general public license. GNU is a recursive acronym which means "GNU is not Unix." The GNU acronym was meant as a means of poking fun at AT&T, which was responsible for one version of Unix. AT&T Unix was an industrial strength operating system that was used widely in Universities because AT&T did not charge a license fee. AT&T later became interested in charging license fees for the use of their Unix after the deregulation of the telephone industry. Universities who used this Unix made extensive improvements to the program and felt that it was not appropriate for AT&T to charge for a program that was largely created by its users.

Richard Stallman is the founder of the Free Software Foundation and was one such disgruntled user of AT&T Unix at Massachusetts Institute of Technology. As a response to AT&T, Stallman created several software tools that later became the basis of a free form of Unix. Stallman released his tools under his own license that he named the GNU GPL. The GNU tools later became the basis of well-known open-source software projects such as the free Berkeley Standard Distribution form of Unix (BSD) and Linux. Linux is a very popular Unix-like operating system created by Linus Torvalds and other contributors that will be detailed later in this paper. Many in information technology and high-end graphic production are using Linux as a replacement for Windows. BSD and Linux have also progressed to the point where they now power over 40% of all web servers (Wayner, 2000).

Mac OS10 and Free Software

Apple's new OS10 (Operating System 10) has brought many free and open-source GNU GPL applications to the Macintosh platform. This is because OS10 is compatible with BSD and Linux. Apple tried to join the open-source movement and attract BSD and Linux developers through their release of part of the source code for OS10. Apple named this program *Darwin*. The Free Software Foundation has criticized Darwin because it does not use the GNU GPL that defines open-source but instead uses a more restrictive license. Regardless of how Darwin was received, it has made it possible for developers to easily port programs over from BSD and Linux. Programs that originated with Linux are now compatible with the new Mac OS.

OS10 also originates from the Nextstep operating system. Next Inc. was the company founded by Steve Jobs, who is the current CEO and past founder of Apple. Next made its own proprietary computers starting in the late 80's and by 1990 the Next workstation had features such as display PostScript and large 24 bit 1024x768 color displays (Stross,

Figure 1: Pixel Enhance is a free image correction program for Mac OS10
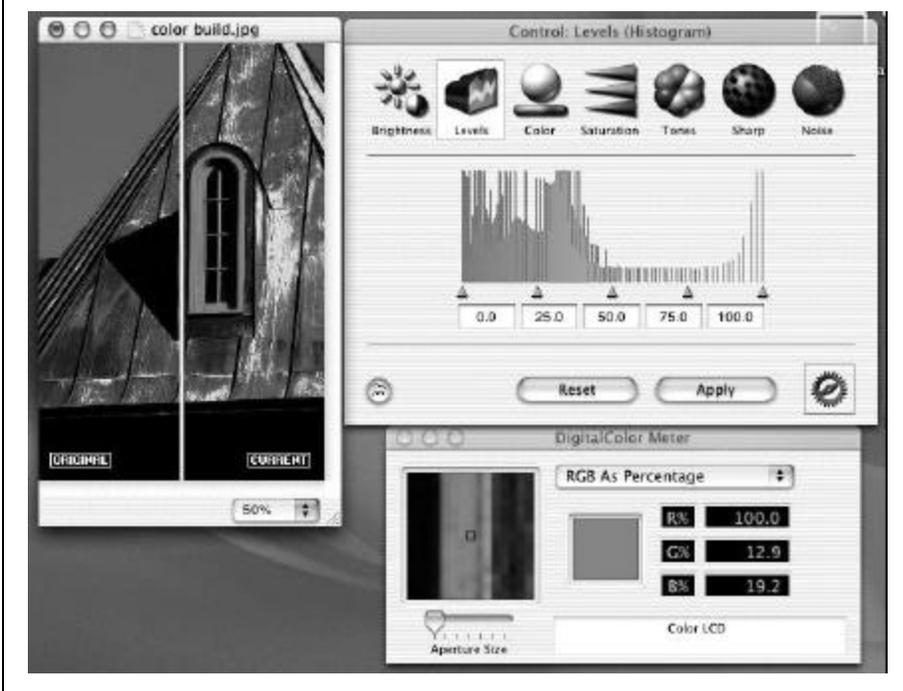
1993). Developers of early image processing software such as *Tiffany* used Next hardware and software because of its graphics capability and ease of programming. Unlike Photoshop, Tiffany has been available for OS10 since the beta version. A free version of the basic image correction tools in Tiffany is available in the form of the *Pixel Enhance* program (see Figure 1). Pixel Enhance is a good means to teach color correction with its before and after views of possible color, contrast and density correc-

tions. Pixel Enhance has all the basic tone correction tools that are in Photoshop, including curves and levels. Pixel Enhance can be downloaded from www.caffeinesoft.com.

Graphic Image Manipulation Program

Graphic Image Manipulation Program (GIMP) started as a computer science class project for Peter Mattis and Spencer Kimball who were undergraduate students at the

Figure 2: The `clone tool` in GIMP is the same as the rubber stamp tool in Photoshop and is used in combination with the brushes palette to retouch damaged photographs

Figure 3: The `layers, channels and paths tools` in GIMP are found in one unified window, as in Photoshop

University of California at Berkeley. GIMP for Windows can be downloaded at http://www.gimp.org/~tml/gimp/win32// and Gimp for Linux is at www.gimp.org. Many unpaid developers have improved GIMP since its start as Version .54 in 1996. GIMP is a Photoshop clone and is an open-source free distribution software under the GNU GPL license. Most of the functionality of Photoshop is available within GIMP. Features such as "script-fu" expand beyond the capability of Photoshop. The GIMP toolbox looks almost identical to Photoshop with little or no learning curve for current Photoshop

users. Tools such as layers, channels and brushes work in an identical fashion to Photoshop. Its hundreds of developers or contributors do not make any money directly off of GIMP. This is the primary reason why Adobe did not sue the makers of GIMP for similarities to Photoshop.

In photo restoration assignments students master the same cloning, burn, dodge, local blur and smudge tools in GIMP that are in Photoshop (see Figure 2). GIMP layers and channels are used in the same way to overlay image elements (see Figure 3). GIMP also has complete image correction and color balance tools

(see Figure 4). The *script-fu* scripting language in GIMP automates repetitive tasks such as image correction, cropping and sizing. Script-Fu is similar to Applescript on a Mac OS computer but is more specific to graphic production. One example is that script-fu can produce custom backgrounds or patterns by recording a sequence of actions that can be infinitely manipulated. Such graphic patterns are then used for web page backgrounds or texture maps for 3D objects.

One of the fundamental differences between GIMP and Photoshop is the pop-down menus.

Figure 4: The curves tool can be used to adjust the contrast and density of the RGB color channels in GIMP
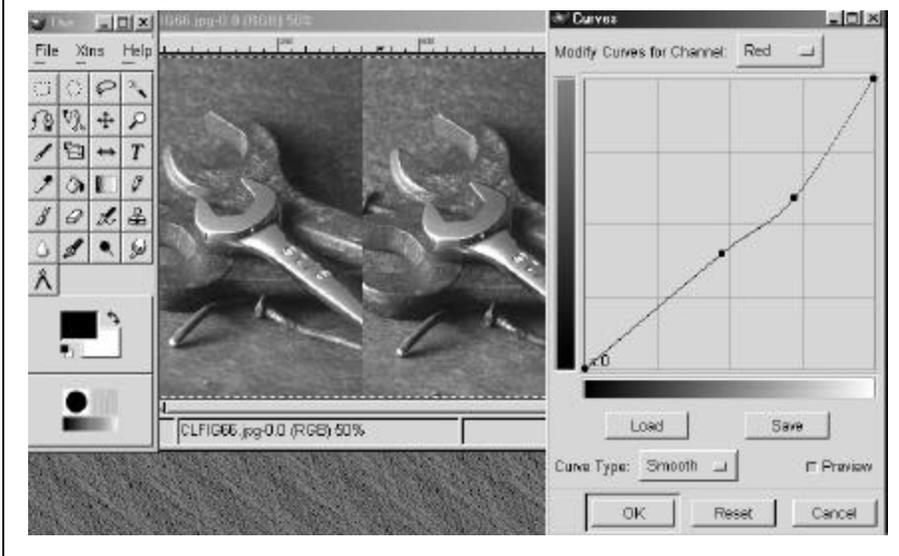
Figure 5: All the controls found in the pop-down menus at the top of the screen in Photoshop can be found by right clicking on an image in GIMP
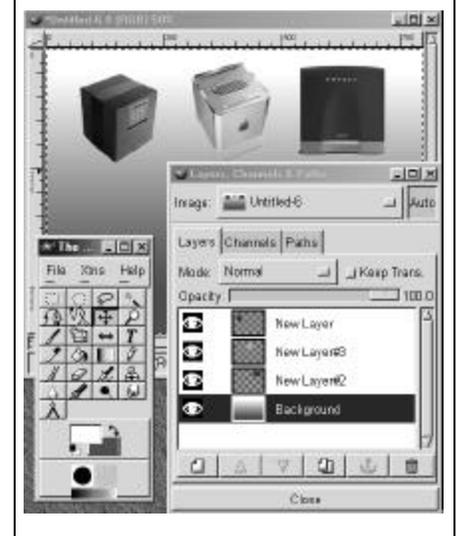
In Photoshop the pop-down menus are located at the top of the desktop, as with most Windows or Mac OS programs. In GIMP the pop-down menus are found by right clicking a two-button mouse on the current image (see Figure 5). This menu accesses almost all the functions of GIMP. It is very easy to transition from any version of Photoshop to GIMP once you become familiar with this difference. Another difference between Photoshop and GIMP is that GIMP is designed from the ground-up for web developers. Photoshop has historically concentrated on print applications because Photoshop predates the web. Photoshop has added many web specific features throughout the last few years but GIMP has been developed from its start with the web in mind. I still teach Photoshop because of its superiority in handling CMYK color space, although GIMP is my program of choice for web development. Many books and training materials are available for GIMP. For a complete reference I would recommend *GIMP: The Official Handbook* (Klander, 1999) and *GIMP: The Essential Reference* (Harford, 2000) as more of an executive summary.

Linux and Free Software

GIMP was originally developed for the Linux operating system.

GIMP's compatibility and co-evolution with Linux is one of its main advantages. Linux is exceptionally stable and is also an efficient user of CPU speed and memory. Older hardware can be used with Linux due to its efficiency with system resources. With Linux I am able to use older PC hardware and I do not experience a dramatic slowdown in performance. I am able to teach basic image editing skills with 166 MHz PC's with only 48 MB of memory. I would need at least a 300 MHz machine

with 64 MB of memory to see the same level of performance with Windows or Mac OS and Photoshop. Admittedly, students will need to work with small file sizes with such hardware but small files are appropriate for web development and the image editing principles are the same.

One unexpected side effect to using Linux in my classes is that some students have become interested in using it as a substitute for Windows. This interest often expands into an advanced knowledge of Linux and web server programs such as Apache. Knowledge of Apache, Linux and Unix are highly sought after in the current job market for network administration positions.

Support can be one of the biggest problems with free or open-source software. Switching from Windows to the Linux operating system has helped with many of the crashes and unexplained errors. This is understandable because some of the free programs covered in this paper started on Unix or Linux and were later ported to Windows and Mac OS. The Linux community also seems to be a smaller and closer-knit user group that I feel is more approachable and less expensive (free in

most cases) when compared with many Microsoft support options.

Several high profile companies that were positioned to support Linux for the average computer user abandoned their efforts due to the downturn in the high-tech sector in 2001. One important example was Corel Linux, which was marketed specifically as a simple to install alternative to Windows and was bundled with full versions of high quality productivity applications such as WordPerfect, Staroffice and Corel Draw. Dell computer is an example of a hardware vendor that has discontinued shipping PC's preinstalled with Linux for the home or workstation market. Many hardware vendors ship PC's with Linux installed for the server market but Dell was an early example of a company focusing on Linux as an alternative to Windows.

Despite these early examples of the failure of Linux to take over the average computer desktop, many educational and institutional users continue to use Linux as an alternative to Windows. Large companies such as IBM and Red Hat, among many others, are supporting Linux for the enterprise user. Linux is a dominant operating system that continues to grow

in market share on servers and on scientific workstations such as in the International Space Station and for the National Weather Radar system. There are several free software projects such as KDE and Gnome positioned to increase the usability of Linux and all hope is not lost that Linux could one day be a widespread and successful competitor to Windows.

One solution to the Linux versus Windows dilemma is to use both on the same computers. This is relatively easy to accomplish with the free *Lilo* boot utility program that is installed with Linux. This can also be done with one of the commercial disk partitioning and boot loader programs such as Partition Magic and Bootmagic (www.powerquest.com/partition-magic/). For those interested in putting more than two operating systems on their computer such as Linux, BSD and Windows, I would recommend reading the *Multiboot Configuration Handbook* (Smith, 1999).

Staroffice

My students have used Powerpoint as part of the standard Microsoft Office suite to present a portfolio of their images to class or to potential employers at job interviews.

Figure 6: The slide sorter view in Staroffice 5.2 is very similar to that found in PowerPoint
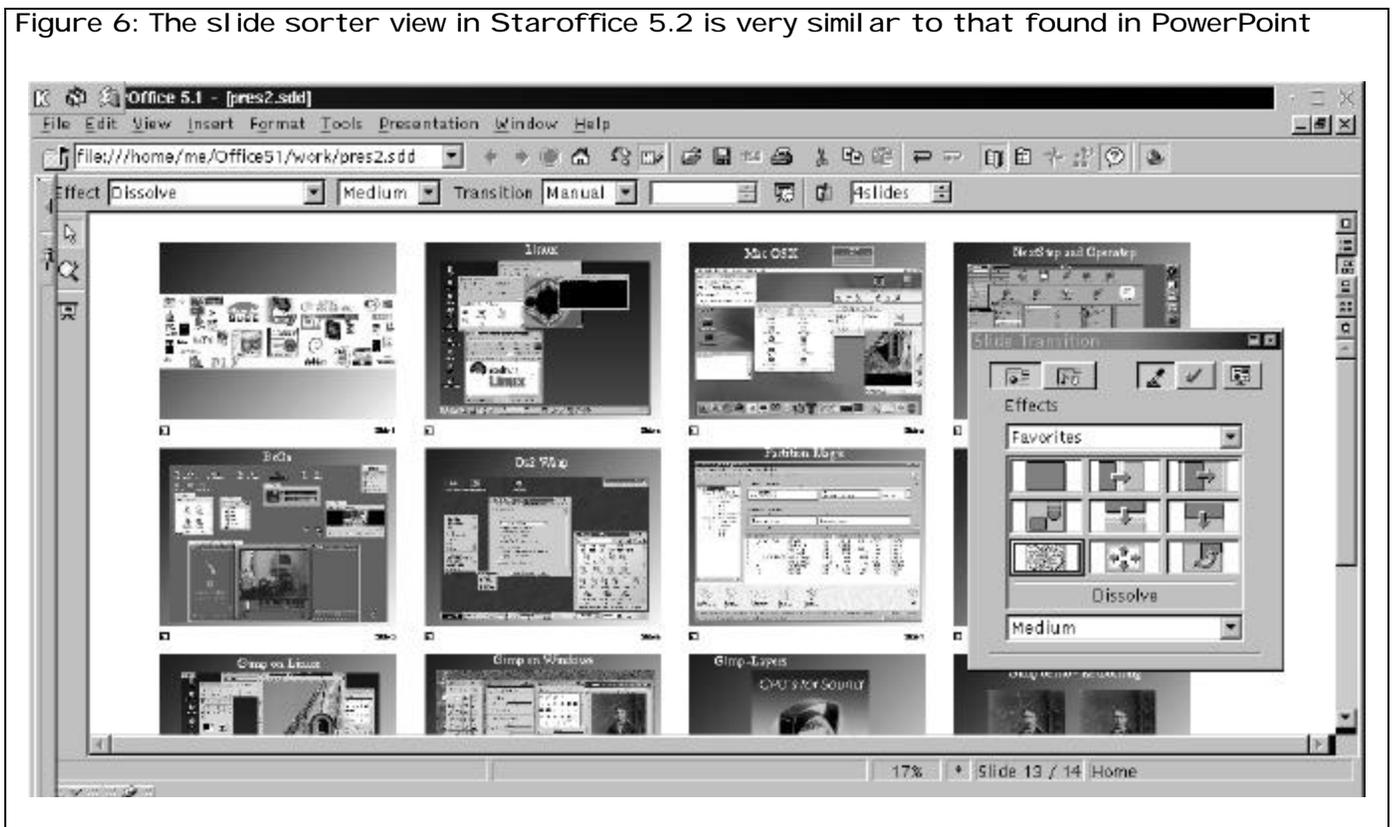
However, office licenses are expensive to maintain, and the current versions of Office have become a large set of programs with a correspondingly large appetite for memory and hard drive space. Some of the computers my students use do not meet the recommended hardware specification for Office. This combination of factors has led me to search for a free alternative to Office that has a smaller memory and hard drive footprint. Staroffice has become the solution I was looking for in recent years (see Figure 6). Staroffice is available for Windows, BSD and Linux. Staroffice was originally a popular Office clone created by the German company Star Division. Staroffice was purchased by the workstation and server manufacturer Sun Microsystems. Sun has continued to develop the program and has made it freely available for download on their website www.sun.com/software/star/. Sun is the originator of Java and Staroffice fully integrates Java applets and scripting. Staroffice is also able to import and export Office files.

Staroffice has word-processing, spreadsheet and presentation components that are true to its description as a clone of Microsoft Office. It also has a few features beyond Office such as a drawing application that can produce vector-based drawings. The Stardraw component in Staroffice is a simple but capable drawing tool. Stardraw has taken the place of Macromedia

Freehand for a simple line drawing and logo assignment in my basic graphic production class.

Staroffice will run quite well on a 166 MHz PC but will require at least 64 MB of memory and 75MB of hard disk space to run smoothly. This program is very stable on Windows 98 and I have had far fewer problems than Office with lock-ups and blue screens on a wide variety of hardware configurations. This is probably because Staroffice is a smaller and less complex program that uses fewer system resources than Office. This simplicity does come at a price and I have not been able to use Staroffice as a total replacement for Powerpoint because it is not as compatible with several movie formats. The 6.0 beta version of Staroffice has added many new features but has not addressed movie compatibility. As a work-around, I can link out of Staroffice to a standalone movie player application and then play any movies I wish.

Users familiar with Office 97 will be quite at home with Staroffice. Importing pictures and setting transitions as well as viewing slides are almost identical to Powerpoint. An added benefit of Staroffice is that I can make larger presentations with more photos

Figure 7: Strata 3D Base is free, has basic modeling tools such as lathe and extrude and is not save-disabled

and slides when compared with PowerPoint on the same machine. This is due to the smaller memory and hard drive footprint. Another advantage is that Staroffice is available for both Windows and Linux and thus allows me to display the same files on either platform. I would recommend Staroffice 5 for Linux (Wells & Taylor, 1999) to those who want to run Staroffice on the Linux operating system.

Strata 3D Base

Trial versions of software are often the least useful because they are

limited in features and/or are save-disabled. Some software makers have followed a different marketing strategy in providing their basic software tool free of charge in order to attract users to a more full featured product. Strata 3D Base, (see Figure 7) is a modeling or 3D content creation program available for downloads from www.strata.com, and is not save-disabled. Strata 3D Plus includes animation and the Pro version adds several advanced modeling tools. These latter two programs have a license fee. I use Strata 3D

Base to teach basic modeling tech-niques such as extruding, lathing, ray tracing and texture mapping. I am not able to animate 3D con-tent and export in the form of a movie but this is not a real limita-tion. I have purchased one copy of the Strata 3D Plus version so I can demonstrate some of the anima-tion controls not available in the base version. Students can move to the workstation with this program and animate their models if they wish.

Blender 3D Modeling

Blender is an open-source and freely distributed 3D modeling and

Figure 8: Blender is a free open-source program that is more full featured than Strata 3D Base but it uses a more complex non-standard user interface
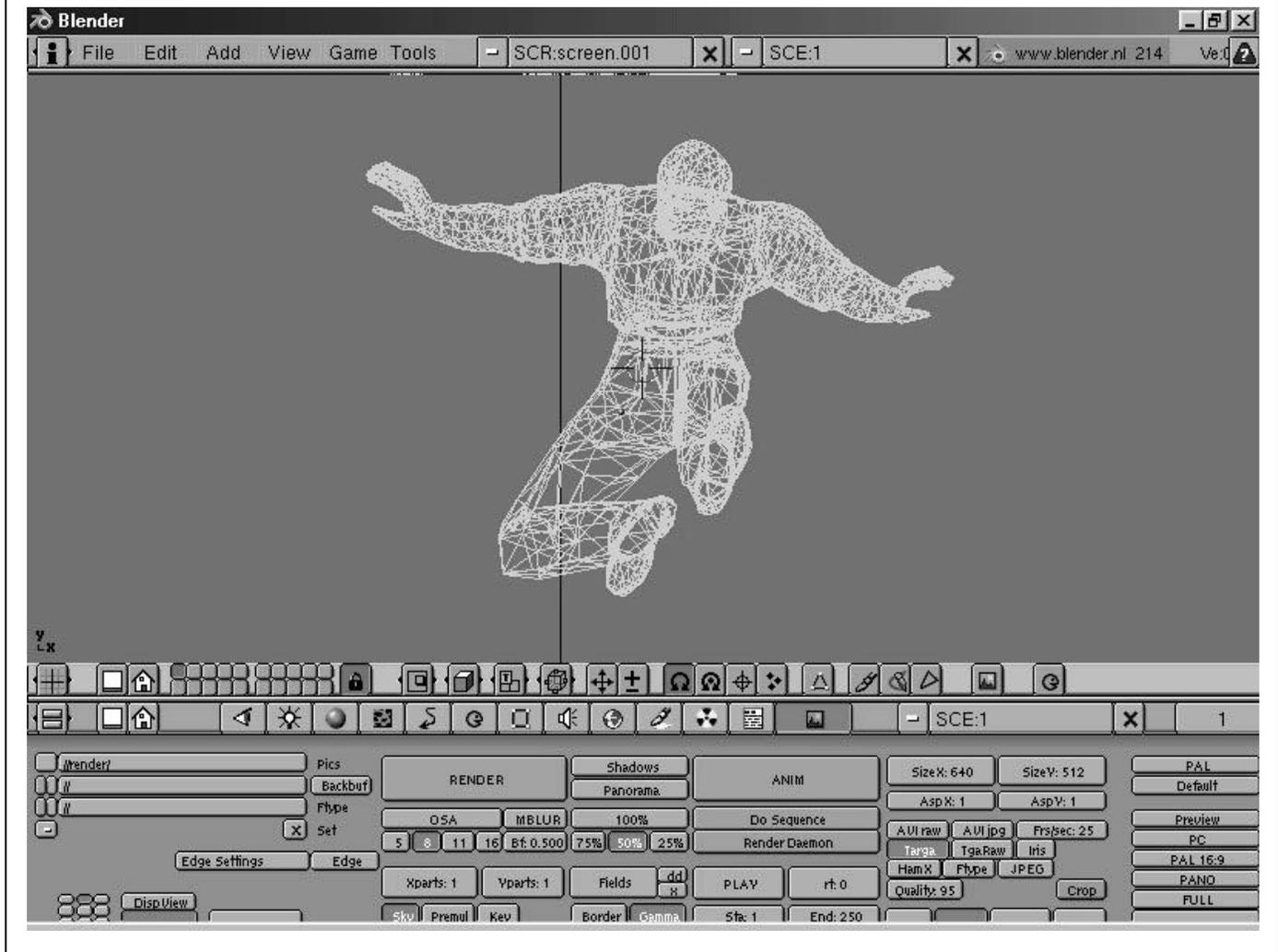
animation program available for download at www.blender3d.com. It is a full-featured program with a steep learning curve, more suitable for an advanced modeling class. This program shows its heritage as an Amiga program. The Amiga was a dedicated graphics computer used extensively in 3D modeling and animation for video production in the early to mid 90's (in the form of Nutek's Video Toaster). Since Blender uses the same interface as it did on the Amiga, it can be confusing to the average Windows and Mac OS user. Blender's interface has a higher degree of efficiency for the advanced user because complex functions are available with simple keystrokes in combination with a three-button mouse (see Figure 8).

Blender is available for Windows, Mac OS, BSD, Linux and Unix. Blender uses very little hard drive space and varies in its use of memory according to the size and complexity of the modeling work. Blender has a similar array of basic modeling tools when compared with Strata 3D Base, but adds advanced texture mapping, ray tracing and animation tools that are only available in the most expensive Strata 3D Pro version. Strata 3D Base does not have enough depth as a basis for an

Figure 9: This window in Photovista is used for the stitching and alignment of individual photos into one large panoramic photograph

entire course in 3D content creation but Blender would be a good alternative for advanced students and curriculum. The blender manual is available for $15 at www.blender3d.com (Roosendaal, 2000).

Quicktime Virtual Reality Movies

Quicktime VR content creation is another graphics application for which I have found trial and open-source alternatives to commercial software. *Object* and *Panorama* movies are the two main types of VR content.

Panoramic VR's are click-and-drag interactive 360-degree movies. The most typical QTVR panorama content on the web is interactive tours of buildings and real estate. An Object VR movie is an interactive click-and-drag view of a small object such as a product advertised on a web page. Object VR's are created from a series of still pictures of the subject or object rotated on a turntable with the camera in a stationary position. Panoramic VR's are also photographed as a series of still pictures but the photos span an entire 360-degree rotation of the camera. The panoramic VR pic-

Figure 10: This window in Panoworx is used for importing individual photos before the stitching or blending process

Mac OS and Windows (see Figure 10). Panoworx is a better choice than Photovista for the Macintosh because Photovista is not compatible with the most current version of the Mac OS.

Objectworx is object VR creation software, (see Figure 11) which is available for trial download at www.vrtoolbox.com/vrobjectworx.html. Objectworx allows the keying-out of original backgrounds so another background can put in place. Object VR's are created on a turntable and keying allows the turntable to be removed and replaced with a more pleasing background picture or pattern. In addition to leaving an icon on the final movie, Objectworx limits users to 15 sessions with the program before it is disabled.

tures are stitched or blended together into one larger seamless picture and then converted to the QTVR movie format. For a more complete review of the QTVR production process I would recommend *The Quicktime VR Handbook* (Kitchens, 1998), or look back at the article on QTVR in the *1998 Visual Communications Journal* (Lantz & Baggett, 1998), that is downloadable on www.igaea.org.

Photovista, Panoworx and Objectworx

Object VR's and panoramic VR's require their own content creation software because each is unique in respect to how they are photographed and then compiled in software. Photovista is panoramic VR creation software that can be downloaded from www.mgisoft.com. The Photovista trial version includes an icon in the final movie that can be edited out with some difficulty in Photoshop or GIMP. Photovista 2.0 is a PC based program. Photovista 1.6 is available for Mac OS (see Figure 9).

Panoworx is another panoramic VR program that is available from www.vrtoolbox.com/vrpanoworx.html. Panoworx is available for both

Apple VR Tools

Apple has some free VR content creation applications available at http://developer.apple.com/ quicktime/quicktimeintro/tools/. *QTVR Object* can create simple object VR's without the aid of a commercial program such as Objectworx. *Make QTVR Panorama 2* can convert panorama VR pictures into a QTVR Panorama movie. This later program can be useful in transforming any 768X2496 pixel Photoshop or

Figure 11: This window in Objectworx is used to import individual views of an object in order to create QTVR object movies
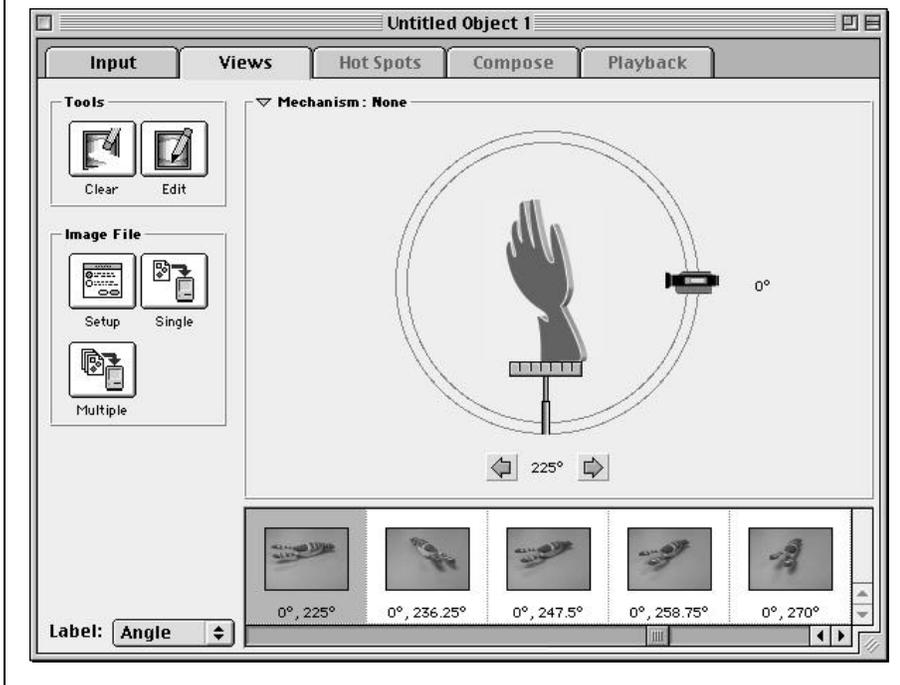
GIMP file into a panoramic movie. The main disadvantage of these applications is that they are available for Apple hardware only, although the resulting movies can be viewed on Windows.

Panomagic and Hotspot VR's

Object and panorama programs can create VR movies but another program is needed to link these movies together into a multi-room tour of a building or environment. Panomagic can take several panoramic and/or object movies and integrate them into one movie

linked by hotspots (see Figure 12). One common example is a hot spot on the door of a room which when selected transports the movie viewer to a different Panoramic VR of another room (see Figure 13). Panomagic is available from www.yonaites.com/PanoMAGIC/ and is a logo embossing trial program.

Panorama Tools

Panorama Tools is a free GNU GPL licensed suite of programs for panoramic VR's downloadable from www.fh-furtwangen.de/~dersch/.

Panorama Tools is available for Windows, Mac OS and Linux. I currently favor the trial VR creation software detailed earlier for lab instruction although I have used Panorama Tools for professional work. The PT Stitcher component of Panorama Tools is often more accurate than some of the commercial applications. It is free and does not leave its logo on finished content.

Transitioning to Free Software

Within the last 10 years, I have used many different computer hardware and software systems for imaging that are now totally obsolete. Were my many hours of training and self-study of these obsolete systems a waste of time? Truthfully yes, where such training concentrated on the specifics of obsolete hardware or the point-and-click training to learn unique menus and commands in programs that no longer exist. However, learning such systems also put me ahead of the curve in some cases because the basic operations or the look and feel of the programs were similar to software that appeared much later on more successful hardware platforms. I am able learn new software applications more quickly as a result of underlying past experience with the common attributes of a

Figure 12: This window in Panomagic is used to link hotspots from one VR movie to another

limiting factor in providing students with the skills they will need in the marketplace when free alternatives are available.

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Figure 13: This is the user interface of a QTVR movie in which the user view can be enlarged; reduced, rotated 360 degrees and hotspots for linking to other movies can be made visible

variety of different obsolete applications.

It is easier to make the transition to free software if you believe that teaching the common attributes of drawing, modeling and imaging programs are more important than particular commands in the most popular commercial software. The final imagery produced by these tools is of greatest importance. It has been my experience that graphic production can be taught just as well in many cases with free software as with commercial products. The cost of commercial software should not be a

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Hypertext: A Brief History

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Introduction

Each day around the world millions of people are using their computers to access the information that makes up the Internet. They search for and retrieve information on all sorts of topics in a wide variety of areas, including arts, humanities, science, business, and recreation. The information appears in a variety of digital formats, such as text, images, audio, or video. Any information that can be digitized is being shared through the Internet. People are also able to communicate with each other using electronic mail (e-mail). All this activity is made possible because of the thousands of networks that are connected making up the Internet.

When you use the World Wide Web (WWW), you are working in a hypertext or hypermedia environment. By using a Web browser (the computer software that lets you access the WWW, i.e., Netscape or Internet Explorer and associated search programs) you can find information on almost any topic in just a few clicks of your computer mouse button. You can move from item to item and back again without following a predefined path, following links according to your personal needs (attributes). The browser makes the connections to a specific WWW site, retrieves information from the site, and displays it on your computer screen.

The information displayed on the computer screen is normally shown in a multimedia format. It may contain text, images, video, and/or audio. You can navigate to other locations on the Internet to search, browse, and retrieve information. You use a mouse to move a browsing tool (a hand) to a link represented by an icon, menu item, region of a map or image, button, or underlined portion of the window, where you click the mouse button. These items are referred to as *hyperlinks* and sometimes are called *hot spots* (Roblyer, Edwards, & Havriluk, 1997). If you've clicked on a link in the document, the browser follows that link; the current display information is replaced by the new linked information.

For this linking system to work, information is exchanged on the WWW according to a specific protocol (set of rules) called *Hypertext Transfer Protocol* (HTTP). Each hyperlink has a particular format, or a *Uniform Resource Locator* (URL). Web pages are written using a language called *Hypertext Markup Language* (HTML).

The term *hypertext* is used to describe text that contains non-linear (non-sequential) links to other text. We use the term *hypermedia* when the hypertext and links are from a variety of media (e.g., text, movies, pictures and audio), as is the case in the WWW (Roblyer, et. al, 1997). On a WWW page or screen, some items are boldfaced, underlined, or colored differently. Each of these items represents a link to another part of the current document, file, page, screen, image, or other Internet resource. You can follow or jump to information the link represents by selecting one of the links or you can return to the previous link. There is a definite starting point,

but the path you take after that is your choice. You are not constrained by having to go in a linear (sequential) order; you can think of being able to move in any non-linear (non-sequential) direction from any link.

So how did all of this *hype* evolve? The term hypertext was coined over three decades ago. Its conceptual foundations go back over five decades. The evolution of hypertext was most directly affected by individuals such as Vannevar Bush, Douglas Engelbart, and Theodor Nelson.

Nelson's Vision

Theodor Holm Nelson, a self-proclaimed computer visionary, coined the term hypertext. As a young Harvard graduate student, Nelson used the term hypertext to describe his concept of non-sequential writing. Nelson felt the computer was too limiting, lacking the ability to branch in other directions. He envisioned hypertext as a solution to speedily access all of the world's literature using a network link that would be available from any computer (Fiderio, 1988).

Nelson believes that hypertext should encourage readers to jump around and alter text to make it more personally meaningful. Furthermore, he envisions an instantaneous publishing and archiving system that is without confusion. He also thinks that everything should be accounted for and not be duplicated (Nelson, 1987).

Readers using Nelson's system to create hyperdocuments can create their own personal browsing paths through the information space based on their own needs and interests. Nelson believes hypertext should be a liberating experience.

Nelson's life work, for over three decades, has been developing a global information network system called *Xanadu* (after the "stately pleasure dome" in Coleridge's poem *Kubla Khan*). Xanadu would have all of the world's knowledge accessible for any user at any workstation.

In his book, *Literary Machines* (1981), Nelson describes Xanadu as a service that every person and company will need for different reasons. He has a very grandiose view of what hypertext can become. He believes that Xanadu stations or *SilverStands* will be like public utilities that can be accessed from home or office. At the Xanadu station a person can open an account and learn to use the system. Help would be available to the user to access the text, graphics, etc. Nelson compares the Xanadu stations with McDonalds' restaurants, where personnel wear neat uniforms which are changed periodically. The menu would include services such as printouts, picture digitization, or even videotape. These SilverStands would be located in highly visible locations. Again, like McDonalds, the stands would be built in modular format making them easy to build and expand in the future (Nelson, 1987).

Ted Nelson believes that knowledge structure is an individualistic process. The text and its structure should be malleable, not set. This accommodates the text to the learner, rather than the learner to the text structure (Jonassen, 1989).

Learning Theory

Learning is a reorganization of knowledge structures. (Jonassen, 1989) Knowledge structures refer to the organization of ideas in semantic memory. These ideas are often referred to as *schema*.

A schema for an object, event, or idea is comprised of a set of attributes. Attributes are the associations that an individual forms around an idea. The schema for *storm*, for instance, is comprised of

attributes such as wind, hail, thunder, lightning, as well as other associations such as tornado, hurricane, etc. Our personal knowledge structure consists of schema of all these attributes, so schemas are embedded within each other. We generate concepts for ideas based upon our association with those concepts.

Each schema that we construct represents a mini-framework in which to interrelate elements or attributes of information about a topic into a single conceptual unit (Norman, Gentner, & Stevens, 1976). These concepts are all arranged in a network of interrelated concepts known as our semantic network. Schema are to memory as nodes are to hypertext. They are the building blocks for memory and hypertext. Hypertext resembles memory.

Hypertext and hypermedia applications in education can include the WWW, computer-orchestrated storybooks, encyclopedias, and tutorials with each having a unique system linking information in the form of sound, dynamic graphics and user directed links. Hypermedia in instruction can support problem solving. It can also enable learners to create new knowledge and become teachers themselves. Learners who

become actively involved in developing their own text can benefit greatly from their experience compared to those who just browse it (Jonassen, 1989).

According to Norman et al. (1976), memory and hypertext have some commonalties. He believes that developing good tutorial/instructional systems involves matching the network structure of the subject matter with the semantic network of the learner. This semantic network is often referred to as *web of concepts* (metaphor of a spider web). Web learning develops a person's semantic learning in a web-like structure. In other words, the person's learning is multi-dimensional, not linear. New material becomes a part of the web in the form of nodes or schemata based upon each learner's individual association with the information.

Similarities and Differences

Two features of any hypertext document are nodes and links. Nodes are the information units of text, graphics, articles, etc. Links are the relations that connect nodes. (Marchionini, 1988) The WWW and Nelson's hypertext have these two elements in common. Nelson's

vision for hypertext allows a user to browse through huge databases of information.

A similarity between Nelson's Hypertext and the WWW today is the freedom of choice provided the user. In Nelson's eyes this liberation is paramount. However, WWW applications with too much freedom of choice and learner independence may cause chaos that many educators are not ready to accept.

Assessment of using the WWW in the classroom is an issue that Nelson does not concern himself with in the Xanadu project. New methods of evaluation will be necessary to properly assess the learner in this interactive learning environment beyond the set of instructional objectives we use to evaluate the learner in a traditional environment.

The WWW allows learners to have control over their access to information in much the same way Ted Nelson envisioned learners to have control over information acquisition. Therefore, users have the freedom to navigate or move around at will in a hypertext environment.

Summary

As we look to the 21st century, educators in all settings are chal-

lenged to develop new ways to manage and best utilize information. Richard Saul Wurman wrote in his book *Information Anxiety* (1989), that there is more information in the *Wall Street Journal* than was available in a lifetime of a person in seventeenth century England. As a society, we must work to manage this information overload, to develop and refine electronic systems for data input, storage, and retrieval.

I believe Ted Nelson's vision is coming true through the World Wide Web and the Internet. People are sharing ideas, information and resources all over the world. Information has become a strategic and valuable resource that is accessible to anyone using the WWW. Networks can help society make changes, improve productivity and improve work life. Networks can also help fulfill people's needs to belong. Ted Nelson's SilverStand just may be the place to go network. You deserve a break to today ... at Xanadu.

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Faculty Training in an Interactive Television (ITV) Classroom

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Introduction

In 1998, 62% of the public four-year higher education institutions in the United States offered courses via two-way interactive video. At that time, 61% of the respondents indicated that distance education delivery utilizing two-way interactive video would start or be increased by their institution within the next three years (National Center for Education Statistics [NCES], 1999). However, only about a quarter of higher education institutions offering distance education courses required faculty to have training in distance education teaching methodologies (NCES, 1999).

A review of research in distance education indicated that even though instruction in the distance education environment resembles traditional instruction, strategies must be incorporated by the teacher to offset the effects of the technology so that communication and dialog can take place between the instructor and the remote students (Smith, 1998). Teaching in a distance-learning classroom is different than teaching in a traditional environment. As Beaudoin (1990) noted, "this is a difficult and threatening situation for teachers, most of whom are themselves products of classroom-bound education and whose professional identities are linked to the traditional image of the teacher at the front of the classroom and at the center of the process" (p. 22).

When an institution is implementing or expanding its distance education component through means of interactive television (ITV), it is important to include training for its faculty.   It is important to note that the success of any new program in higher education is dependent upon the innovation being supported and implemented by the faculty of the institution (Hall, George, & Rutherford, 1986). In describing their development of the *Concerns Based Assessment Model* (CBAM), Hord, Rutherford, Huling-Austin, and Hall (1998) wrote, "the single most important factor in any change process is the people who will be most affected by the change" (p. 29). Even though the technology and the institution are important to the successful implementation of a distance education program, the faculty, staff, and administrators utilizing the system are the most important factors in successful implementation (Hord et al., 1998). Moore and Kearsley (1996) suggested that success of a distance education program in an institution is dependent upon the internal commitment by the teachers and others within the organization. Personnel must be given the necessary training to alleviate their concerns about the new innovation so that the change process can be accomplished and successful implementation of the innovation can occur, not only because of the personnel involved in the endeavor but because of the expense of implementing and continuing ITV programs.

Problem Statement

The use of distance education technologies to deliver instruction to geographically bound or time-restrained students has become commonplace among higher education institutions. This study was undertaken to determine if formal distance education classroom training or classroom training combined with laboratory experiences would affect the concerns of college faculty and administrators about the implementation of distance education in their institution.

Research Question

Do the stages of concern, as measured by the *Stages of Concern Questionnaire* (SoCQ), differ among groups of college faculty and administrators who are expected to begin delivering instruction via distance education and who receive (a) classroom training on distance education, or (b) classroom training and laboratory experiences on distance education.

Research Methodology

This research was conducted at Texas State Technical College-Marshall (TSTC-M), which is located in Marshall, Texas, a rural East Texas town of approximately 25,000 people. The college is part of the TSTC system, the only state-supported technical college system in Texas.

The instrument used in this study was the *Stages of Concern Questionnaire* (SoCQ) developed by Hall and Hord (1987) for the purpose of assessing change in individuals' concerns when an innovation is introduced. Hall and Hord (1987) recommended, "for more systematic study and for research and evaluation efforts where reliability of data is particularly important, the Stages of Concern Questionnaire is the assessment technique to use" (p. 68).

The validity of the SoCQ instrument was established by Hall et al. (1986) over two and one-half years of research with "intercorrelation matrices, judgments of concerns based on interview data, and confirmation of expected group differences and changes over time" (p. 12). The seven stages of concern (awareness, informational, personal, management, consequence, collaboration and refocusing) are grouped into the three dimensions of self, task and impact. They are assessed using the SoCQ and represent a developmental sequence that an individual progresses through when confronted with change or innovation.

The population for this study was comprised of full-time faculty and administrators of the college. The population was divided into three groups for the purpose of this study. The first group, the classroom group, consisted of personnel who participated in only the classroom portion of the distance education training activities. The second group, the classroom and laboratory group, participated in the classroom training and completed an additional 18 hours of hands-on training in the distance-learning classroom. The third group served as the control group for the study.

Each participant in all three groups received the 35-item SoCQ questionnaire on the first day of the scheduled classroom training. Respondents were given as much time as necessary to complete the survey.

The control group attended the first fifteen minutes of the first scheduled classroom training to complete the survey. Once their survey questionnaire was returned, the control group members were dismissed from the classroom training session. The other group members completed a three hour informational session about distance education teaching methodologies.

Respondents indicated on a Likert scale the degree to which each concern was true and circled a number from 0 to 7 on the printed scale. Each series of the questionnaire consisted of items that are important at a certain stage of concern, according to the Hall et al. (1986) concerns theory. Each of the seven stages of concern was represented by five questions on the survey. A scale score was obtained for the peak score and for each of the stages of concerns on the questionnaire.

Personnel were placed into two groups because of scheduling conflicts. Each group met one day every second week for three hours of instruction. Classroom training consisted of three, three-hour sessions over six weeks of instruction. Participants took part in discussion and hands-on activities that familiarized them with the technology and the necessary skills for teaching at a distance. At the conclusion of the last classroom session, the participants who elected to end their training with the classroom portion were administered the SoCQ as a posttest.

The classroom and laboratory group was comprised of the faculty and administrators who wished to receive college credit for their participation in the classroom ses-

sions. In order to receive credit, this group participated in 18 hours of individual, hands-on practice in the distance-learning classroom in addition to the classroom instruction. Logs were maintained in the classroom. Logs were reviewed by the researcher and by the Dean of Instruction for TSTC-M to ensure that each participant completed the required 18 hours of practice. Participants presented a 10-minute lesson in their subject area to a remote site as part of their course requirements for credit at the conclusion of the practice sessions. Upon completion of the presentations the SoCQ was administered to the classroom and laboratory group and to the control group.

Results of the Data Analysis

The initial pretest score on the *Stages of Concern Questionnaire* was used as the covariate in this study. Analysis of covariance (ANCOVA) was used to adjust for initial differences between groups before a comparison of the within and between groups was made. Gall M.D., Borg and Gall W.R. (1996) suggested that "the preferred statistical method is analysis of covariance in which the posttest mean of the experimental group is compared with the posttest mean of

the control group with the pretest scores used as a covariate" (p. 496). Independent t tests of least squares means were conducted on the comparison results of the groups to determine which differences between and among groups were significant. Data obtained from the SoCQ were hand-scored using the Quick Scoring Device included in the Hall et al. (1986) manual about measuring the stages of concern of an innovation. Data was transferred by hand to scoring sheets. Raw scores, the sum of the responses to the five questions matching each stage of concern from the scoring sheets, were entered into the SAS statistical program (SAS Software, 1999), which was used to analyze the data.

Concerns research shows that concerns change over time in a developmental manner. Because this is true, professional development for faculty and administrators should address the stages of concern in a progressive manner if the innovation is to be effective. The sum of the responses to the five questions addressing each of the seven stages of concern should show the progressive development of an individual or group moving from a high awareness or self concern to the refocusing concern that

indicates acceptance and willingness to implement an innovation (Hall & Hord, 1987). The SoCQ identifies the concerns of individuals involved in change. The concerns are developmental in nature as the implementation of change progresses in an organization or institution (Hord et al., 1998).

The seven stages may be grouped into three dimensions of self, task, and impact which was the method used in this study. The developmental nature of change shows that individuals have more self-concerns at early stages of innovation. As implementation is effected, they move to task concerns. At later implementation phases, they are concerned with the impact of the innovation. Hord et al. (1998) noted that "when teachers' most intense concerns are about the effects of an innovation on students and what can be done to improve the effectiveness of the program, they have reached the impact level" (pp. 31-32). The analysis of covariance procedure was used to determine if the concerns of college faculty and administrators were progressing from the self-level to the impact level as a result of classroom and classroom and laboratory experiences in distance education methodologies.

Table 1: Analysis of covariance of stages of concern grouped into dimensions

Dimension probability	Adjusted mean (se)	F-value	Probability
Self (0, 1, 2)		98	ns
Classroom	36.86 (4.31)		
Classroom and Laboratory	44.66 (3.82)		
Control	41.04 (4.47)		
Task (3)		7.04	p < .01
Classroom	11.97 (2.11)		
Classroom and Laboratory	17.11 (1.93)*		
Control	6.47 (2.11)*		
Impact (4, 5, 6)		12.61	p < .01
Classroom	41.33 (4.31)*		
Classroom and Laboratory	60.04 (3.59)*+		
Control	33.97 (4.83) +		

*indicates significant difference between means designated *
+indicates significant difference between means designated +

Results of the data analysis of the stages of concern were grouped into dimensions for reporting purposes. The data analysis indicated that a significant difference at the p < .01 level of confidence occurred in two of the three dimensions for the classroom combined with laboratory experiences group. ANCOVA results for each group in each of the three dimensions are presented in Table 1.

When evaluating the classroom and laboratory group in this study, the analysis of the data indicated that this group had shifted its focus away from concerns primarily about self and had begun to evaluate the management, consequence, collaboration, and refocusing stages that are essential for the new innovation, distance education, to be successful at TSTC-M.

High concerns in stage 3 for the classroom and laboratory group indicated that this group was concerned about logistics, time and management concerns. The highest adjusted mean score for the classroom and laboratory group occurred in stage 4. This indicated that the group had concerns about the effects of distance learning on students. Their next highest adjusted mean score was in the adjacent stage 5, collaboration. This indicated that the group had concerns about the collaborative efforts of distance learning. The high score on the refocusing stage, with a low score in the awareness stage, indicated that the group who had participated in classroom and laboratory experiences tended to be positive in attitudes toward the innovation and were concerned about its effects on students. They were also concerned with collaboration efforts among colleagues that would make distance education more effective.

Grouping the stages of concern into dimensions presents a clear picture of the progression of the three groups used in the study. The highest adjusted mean score for the classroom and laboratory group occurred at the impact level. Hall and Hord (1987) wrote that "for ultimate success from a concerns-

Figure 1: Line graph representation of the peak scores for the classroom group, classroom and laboratory group, and the control group on each of the seven stages of concern
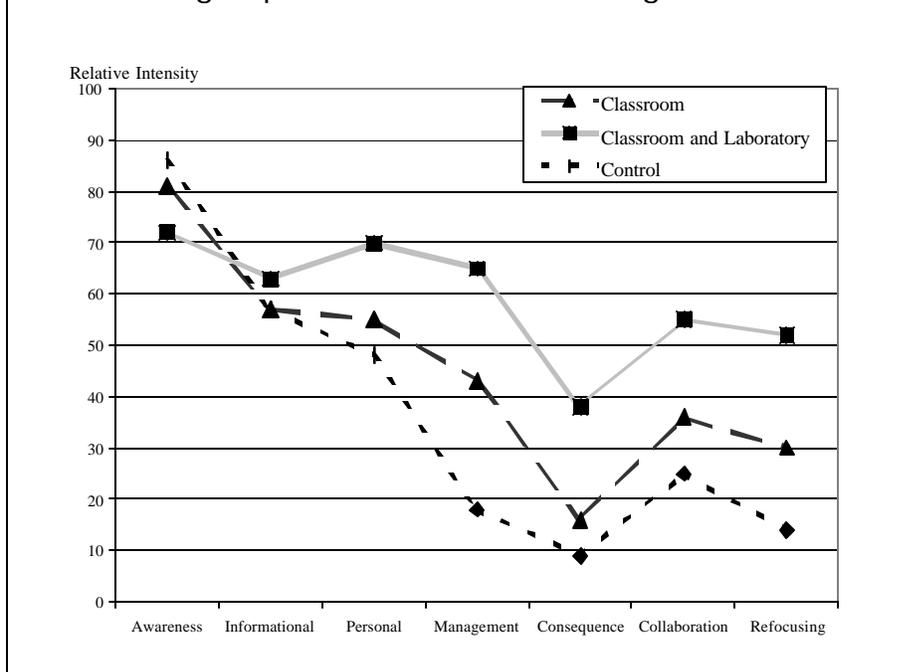
based point of view, the resolution of self and task concerns is only part of the final goal. The arousal of impact concerns is also desirable" (p. 74). The classroom and laboratory group benefited from the nine hours of classroom instruction and the additional 18 hours of laboratory experiences. Their progression on the stages of concern indicated that this experimental treatment was effective in addressing the concerns, attitudes and perceptions of the group. After classroom and laboratory experi-

ences, this group was more concerned with the processes and/or tasks of distance education, the impact of distance education on students, and the coordination and cooperation with colleagues to make distance education successful at TSTC-M.

Significant differences occurred in the task and the impact dimensions between the classroom and laboratory group and the control group. This indicated that classroom training and laboratory experiences were effective in assisting

college faculty and administrators to progress more rapidly through the stages of concern about distance education. Significant differences also occurred in the impact dimension between the classroom and laboratory group and the classroom group indicating that training and laboratory experience affected stages of concern about distance education.

The concerns of nonusers are typically the highest on stages 0, 1, and 2, and typically lowest on stages 4, 5, and 6. The highest adjusted mean score for the control group occurred in the self dimension. This indicated that the group was more concerned with personal position and well being in relation to the change. The responses for the control group followed the typical pattern of a nonuser of distance education. This group appeared to have little interest in distance education.

The results of this study should not be generalized to extend to other institutional groups without comparative data. The findings must also be viewed with limitations specified by the experimental design, the participating faculty and administrators, the researcher, the questionnaire, and the statistical analysis.

Analysis of Peak Scores in Data Results

Hall et al. (1986) suggested that "the simplest form of interpretation is to identify the highest stage score" (p.29). To determine the highest score in grouped data, the approach is to tally the number of participants who are high on each stage. This gives a clear picture of the high scores within a group (Hall et al., 1986).

Another way to identify the peak stage for a group is to aggregate individual data in a profile that presents mean scores for each stage. Hall et al. (1986) suggested that "normally, the group averages will reflect the dominant high and low Stages of Concern of the composite group" (p. 32). When analyzing these data, the raw scores are computed by summing the scores on each of the five questions in each stage. When interpreting the peak score, the raw score is converted to a percentile score.

The group data for peak scores on the Stages of Concern are presented in Figure 1. The line graph is a pictorial representation of the peak scores on each stage of the SoCQ among the three groups. The adjusted means of the summed

raw scores were converted to percentile scores using the procedures recommended by Hall et al. (1986).

Conclusions and Recommendations

1. The classroom training combined with laboratory experiences strategy was more effective than classroom instruction only or no treatment, for addressing concerns of college faculty about the innovation of distance education.

2. The classroom training combined with laboratory experiences strategy was more effective than classroom instruction only or no treatment, to prepare faculty and administrators for teaching in a distance education classroom.

3. The classroom training combined with laboratory experiences strategy was more effective than classroom instruction only or no treatment, to help faculty and administrators move from the early stages of concern, awareness, informational, personal, to the task and impact stages of concern of management, consequence, collaboration, and refocusing.

4. The SoCQ was an effective instrument for evaluating faculty

and administrator concerns about the innovation of distance education.

5. Classroom and classroom combined with laboratory experiences are important to the successful implementation of distance education platforms.

6. Faculty and administrators will be more willing to accept and institutionalize the new innovation of teaching in a distance-learning environment as a result of classroom instruction and classroom instruction combined with laboratory experiences.

7. Professional development in distance education methodologies should be offered to faculty and administrators to address their concerns about the new innovation and to increase adoption of the innovation.

8. The results of this study corroborate the evidence found in the review of the literature that classroom training combined with laboratory experiences should be provided to all users of telecommunications systems.

9. Training in distance education methodologies is a critical component for successful institutionalization of an innovation.

Determining if classroom training and classroom experiences aid in the smooth acquisition of the innovation of distance education programming provides pertinent and useful data on how higher education administrators and faculty embrace and adapt to change as measured by the SoCQ. This study was conducted under the assumption that personnel implementing distance education programs desire a smooth and successful adoption of the innovation.

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Establishing a Computer-Mediated Communication Laboratory in a Graphic Communications Department

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Abstract

A number of benefits have been associated with using computer-mediated communication (CMC) to improve instruction. CMC is a blend of computer and telecommunication networks that are used to compose, store, deliver, and process communication. Computer-mediated communication has the potential of becoming a powerful means of merging information from a variety of sources. It is relevant to collaboration, student participation, and individualized instruction. CMC can be used for daily information exchange among colleagues, between faculty and their students, among students, for delivering distance education, and for providing access to resources and information.

The primary goal for a Computer-Mediated Communication Laboratory (CMC-L) is to provide educators and university undergraduate and graduate students with instructional tools that can be useful in meeting information challenges of today. Some educators are using CMC for classroom instruction to help manage the complexities of an information-based society. "No longer are teachers the sole experts and information providers, teachers become facilitators and guides" (Berge & Collins, 1995, p. 6).

Introduction

Computer-mediated communication (CMC) refers to communicating at a distance by means of a network that utilizes a personal or mainframe computer as a communication medium (Holden & Mitchell, 1992, Basham, 1991). This communication includes any educational exchange of information available at a distance. Transmitted information can include text, graphics, or other CMC correspondence study, computer-mediated course work, live one-way or interactive, or prerecorded televised courses utilizing satellite, ground or microwave broadcast, and audio-teleconferencing (telephone) courses. CMC is also multidimensional allowing the transmission and reception of not only text and graphics, but also animation, video, and sound sequence with multiple information paths that allow for a dynamic, interactive interface (Defining software for the curriculum, 1994). CMC is one of the fastest growing technologies, in terms of the numbers of teachers and learners who are using it (Johnston, 1992). Many teachers found with computer-mediated communication that the level of teacher-student and student-student interactions is higher than in most traditional classroom settings (Kearsley & Lynch, 1991, Grabowski & Pusch, 1990; Boshier, 1990; Davie, 1987).

A Computer-Mediated Communication Laboratory must have the state-of-the art personal computers, network equipment, software, and printers to help establish the CMC -L for undergraduate and graduate education. This laboratory will enhance the delivery of technical instruction not only to undergraduates and graduates on campus but also

undergraduate and graduate students off campus by answering questions, solving problems, and explore new ideas for people to work together via the internet.

Proposed CMC Laboratory

The primary goal for a Computer-Mediated Communication Laboratory is to provide educators and undergraduate and graduate students with instructional tools that can be useful in meeting information challenges of today. Satellites, video recorders, and computerized data can eliminate not only distance barriers, but time barriers as well (Grabowski & Pusch, 1990; Kamper, 199l; Mason, 1990; Norton & Stammen, 1990; Tooey & Wester, 1989). CMC -L can make the teaching and learning process more flexible and instruction more effective in aspects such as speed, cost effectiveness, flexibility and convenience (Goode & Johnson, 1991, Phelps, Wells, Ashworth, & Hahn, 1990; Grabowski & Pusch 1990; Romiszowski & Josh, 1989; Kaye, 1987).

Capabilities of the CMC Laboratory

One of the greatest challenges that face university professors today is how to delivery technical education to the maximum number of undergraduates and graduates with the least investment in infrastructure. The CMC-L allows professors to deliver technical lectures to undergraduate students online via the World Wide Web. The types of courses that are to be delivered via the CMC-L includes Cellular Communication Systems, Optical Communication Systems, Satellite Communication Systems, Graphic Animation, Advanced Multimedia, Videographic, Electronic Imaging, Distance Education from the Graphic Communication Department.

Need for a CMC Laboratory

A CMC-L provides the following benefits:

1. Training - This system helps develop skilled personnel for the industry, and provide a service that will assist companies in having a ready cadre of applicants from which to choose as they seek to replace and/or expand their work force.
2. Exposure - Universities can be a pioneer in seeing that students are in the forefront with the latest equipment and software in order to give the students a quality education and to maintain competitive programs.
3. Advertisement - When students learn and are exposed and trained on certain equipment, they enhance the reputation of the University.

Implementation

The equipment that will compose the CMC-L will provide the department and university with sufficient infrastructure to implement this distance learning option for undergraduate and graduate students. The university must have space allocated for CMC-L and have the necessary infrastructure to support the lab with cables for networking, computer desks, and chairs.

Both faculty and students should take an active role in the development, maintenance, and use of this laboratory. However, there must be an accountable person or persons responsible for the laboratory.

Faculty, students, and technicians can be responsible for installation of the required equipment. In reference to the students, this will give them hands-on experience in the implementation of a state-of-the-art lab such as the CMC-L. This will also help the students feel like they are part of the development of a CMC-Laboratory.

University Support for the CMC Laboratory

From the top-down there must be an overall commitment toward growth as well as to expose the students to the current trends in technology. Computer-mediated communication is recognized as a growth area for developing a vibrant program. The first step toward this goal is to develop a collaborative effort between departments, such as graphics communication systems, engineering, and electronics. Second, this collaborative effort should extend to include corporate America.

Conclusion

Developing a laboratory in CMC is needed to keep departments and universities on the cutting edge of technological and engineering instruction. We must be committed to excellence in education and strive to provide real-world experiences for the students. This type of laboratory will make students more employable and provide employers with applicants that have extensive training on the information super-highway.

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Taking the Magic Out of Scanning

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Introduction

When you scan a picture, you are often told to scan it at 300 dpi, without further information on why this is the case. This happens in both a school or work setting, and in fact many people working in positions of graphic design or pre-press know only how to scan it right without an understanding of this magic number. But why it is not more or less than 300 dpi? Let's investigate.

Basic Terminology

The first step in scanning is to determine the type of copy we have: line or continuous tone. Line copy is high contrast artwork without any shades of gray. Black and white clipart would be an example, as well as a pen drawing or even text on a page. Continuous tone copy, on the other hand, has gradations in tone, also known as gray levels. Examples include a black and white photograph, color photograph, or a painted picture.

Actually, dots per inch (dpi) is not the best term for scanning although it is often used.   DPI is better used to describe how many physical dots a laser or inkjet printer creates in one inch. For example, a 600 dpi laser printer can print 600 dots in one linear inch. Samples per inch (spi) is the best term to use for scanning resolution. It describes how many sample points are acquired from the original image in one inch. For example, if I scan an image at 300 spi then I am picking up (sampling) information from 300 points on the image in each linear inch.

While we are on the topic of terminology, there are two other terms which may confuse people: ppi and lpi. PPI (pixels per inch) refers to the number of pixels in a picture that is in digital format , but also is used to describe monitor resolution (Romano & Romano,1998). Again, dpi is sometimes used, but ppi is preferred. LPI (lines per inch) is the resolution for a halftone screen. It refers to how an image will be divided into cells for output. For a high quality magazine, an image is often made into a halftone with 150 lines per inch.

Scanning Resolution Depends on Output Resolution

Resolution for scanning depends on printer resolution, so it is helpful to understand printing resolution first. Basically, what a digital printer does is create an image on a surface by printing dots from left to right and then gradually moving down the page. For a 600 dpi black and white laser printer to print on letter size paper it needs to move from left to right 6,600 times, or 600 lines of dots multiplied by 11 inches. If your laser printer can print 20 pages per minute then it can move at least 132,000 times from left to right in a minute. If every dot is printed, this is 79,200,000 dots! And we still complain about print speed!

The highest resolution (dpi) a printer can reach refers to its addressability. The addressability refers to the maximum number of printer dots that can be generated in an inch. A 600 dpi printer has an addressability of 600 dots although it might also be used to print at 300 dpi. A 2,400 dpi

Figure 1: Printer dot, halftone cell, and halftone image

Printer Dot   Halftone Cell   Halftone Image
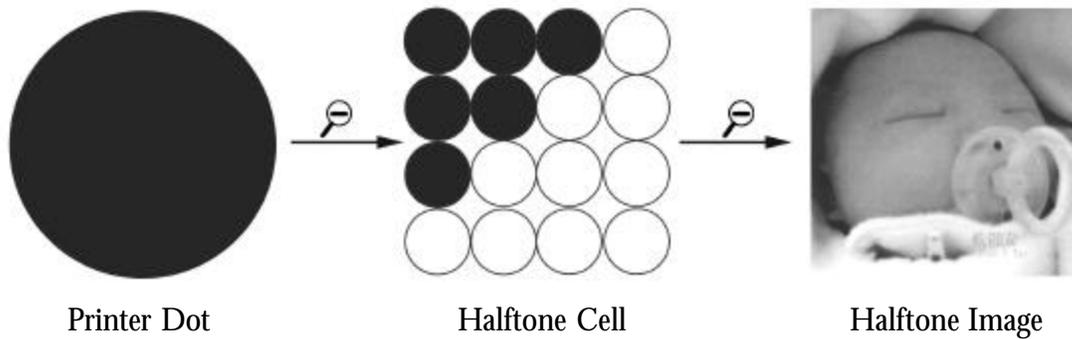
imagesetter has an addressability of 2,400 dots, but might also be set to print at 600 or 1200 dpi.

Scanning Line Images

Since line copy is high contrast, such as a black image on a white background, it is easy to see any unevenness on the edge of the image. For this reason, line copy is scanned at a fairly high resolution compared to continuous tone copy. Typically, the scanning resolution (spi) is equal to the output resolution (dpi), up to about 800 spi for an imagesetter. After 800 spi, there is little noticeable difference to the eye in the edges of the image.

When too low a resolution is used, aliasing (jaggies or stair-stepping) will become apparent on the edges of the image. Essentially we want to use the lowest resolution where this is not apparent. So, if

we have a 600 dpi printer, we can scan at 600 spi and there should be no jaggies. However, if we scan at 1200 spi, the image quality will be the same (no jaggies), but the file size will be much larger, which is undesirable.
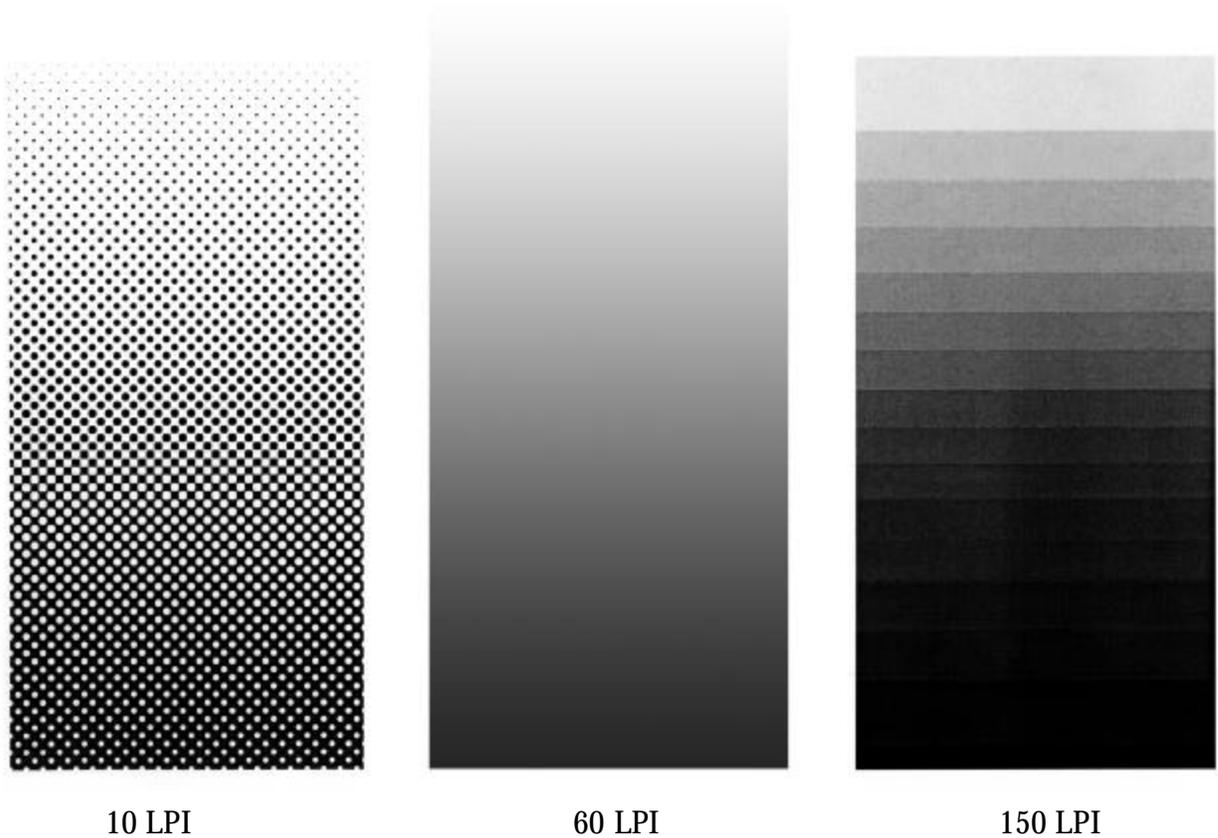
Halftones

Halftones originated because of the limitations of printing inks and printing presses. For example, if you want to print a black and white photograph on a printing press, or even your inkjet printer, you use only black ink. So, how do you get shades of gray? The answer is the halftone. By breaking the image up into small dots, with large dots being shadow areas and smaller dots being highlights, you get the illusion of the original photograph. This is because our eyes cannot see (resolve) the tiny dots

and so blend them together on the page to create various shades of gray. Halftones are used for color images as well, but in this case, inks are cyan, magenta, yellow and black, and each color is printed as dots on the surface.

Digital halftones are pictures (formerly continuous tone pictures) that are broken up into square halftone cells. A 65 lpi halftone has 65 cells in one linear inch. Each cell is made up of a number of printer dots and these are turned on or off to create light and dark areas. (see Figure 1) Think of a white checkerboard (matrix) that you can place black checkers on at random. No checkers would be white (nothing printed), and all checkers would be black. Half the checkers would be 50% gray, and so forth. This is one halftone cell.

Figure 2: A gradient printed by a 600 dpi laser printer at 10, 60, and 150 lpi

10 LPI   60 LPI   150 LPI

In the case of a cell that has 4 printer dots (2 x 2 in a square), then this can print as all white (nothing printed) or 4 levels of darkness (1 - 4 printer dots printing). Ideally, you would have 256 printer dots (16 dots x 16 dots in a square) in each halftone cell, which can give you 256 levels of darkness (1 - 256 dots printing). When you add the option of no dots being printed, this makes 257 different options for one halftone cell!

Actually, 256 printing dots in each cell is ideal for the highest quality printing. However, the human eye can only see about 120 levels. So, in some cases, especially when printer resolution is low, it is permissible to have fewer printer dots in a halftone cell, such as 10 x 10, or 100 gray levels or tones.

Halftone Screen Resolution

Screen ruling, a.k.a. screen frequency or lines per inch, is a measure of how many rows of halftone

cells fit in one inch. Screen ruling is determined by the detail needed and the absorption of the paper used. Newsprint, uncoated and coated papers absorb ink differently. Coarse screens (85 - 100 lpi) are used for newspapers. Finer screens, such as 133 - 150 lpi, are used for color work on coated stock in magazines. Most offset quick printing on uncoated paper requires a 100 - 133 lpi screen, while coated stock requires a 150 - 300 lpi screen. Common screen rulings are 65, 85, 100, 120, 133, 150, 175, and 200 lpi.

Screen resolution is also dependent on printer resolution, especially if printer resolution is low. For example, if you have a 600 dpi printer, and you want 100 gray levels, then the highest screen resolution would be 60 lpi. This is determined by dividing 600 (number of printer dots in one linear inch) by 10 (number of printer dots along one side of a 10 x 10, or 100 dot halftone cell). So, if you want 256 gray levels, the screen resolution would be 37.5 lpi, which is unacceptably low. In this case, a higher resolution output device would be needed, such as 2400 dpi.

If the halftone screen frequency (lpi) is very low, as in the 37.5 lpi

example above, then the halftone cells are very large. If they are too large, our eyes can see the individual halftone dots, defeating the whole purpose of a halftone (blending the dots with our eyes into grays). If the halftone screen frequency (lpi) is too high for the printer resolution, then too few levels of gray can be printed, and posterization (banding) occurs, which gives a stair-stepping appearance from one gray level to another (see Figure 2).

The Relationship Between Screen Frequency and Image Resolution

When scanning, a typical method for calculating samples per inch, which in turn becomes pixels per inch when the image is stored, is to double the halftone screen ruling. For example, if the screen to be used is100 lpi, then you need a 200 ppi image. This is for an image that will be printed at the original size.

How does the image resolution (ppi) of a digital image relate to lpi? I mentioned that the rule of thumb is that ppi needs to be twice the lpi. Why is this? If technology were perfect, then one halftone cell would need only one pixel of the image. However, this is not the case. So, with ppi at twice the lpi, 4 pixels are in each halftone cell (2 x 2), and this is adequate. Actually,

1.5 pixels per cell will also work, so the range is typically 1.5 to 2 times pixels per cell.

Steps for Scanning

1. Determine your type of original: line copy or continuous tone. If it is line copy, scan at the printer resolution up to 800 dpi. For example, you scan at 600 spi for a 600 dpi laser printer, and you scan at 800 spi for an imagesetter or platesetter that has 2,400 dpi addressability.

2. Continuous tone copy will be printed as a halftone. If printer resolution is low, then you are limited as to the screen resolution. For a 600 dpi printer, if you want 100 gray levels (actually 101 with white) for each cell (10 x 10), then the screen resolution must be no finer than 60 lpi. A 1200 or 2400 dpi printer allows for more printer dots in each halftone cell, so there will be more options in regard to gray levels and screen resolution. With 2400 dpi, you can have 256 gray levels (actually 257 with white) and a 150 lpi halftone screen.

3. Resizing (scaling) is typically done in a photo-editing program or page layout program. When scanning, you need to be

Table 1: The formulas for scanning line and continous tone images

Line Copy Formula
Scan Resolution (SPI) = (Final image width or height) / (Original image width or height) x Printer DPI (up to 800)

Continuous Tone Copy Formula
Scan Resolution (SPI) = (Final image width or height / Original image width or height) x Screen Ruling (LPI) x 2

sure that the chosen resolution for your images takes resizing into account. For example, line copy that is to be scaled to 200% should be scanned at 1200 spi in order to print at the correct resolution on a 600 dpi laser printer (see Table 1).

Let's say that I have a 2" high image and I want it to be 4" high in my publication. I also know that I want to use a screen ruling of 100 lpi. So, 2 x 100 x 2 = 400 spi.

Summary

As you can see, there is more to scanning than simply choosing 300 spi for the scanning resolution. Factors to consider include type of copy, printer resolution, halftone screen resolution desired, and scaling. Done correctly, file size will be kept to a minimum while image quality is optimized. This takes the magic out of the formula, but replaces it with understanding.

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The Re-evolution of Visual Language: Student-Produced Film in the K-12 Classroom

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In the late 19th century, the second mass media revolution (the first being the introduction of the printing press) occurred. It was at this time that pioneers and visionaries began to experiment with ways to make still pictures move. As these new and exciting technologies developed, humans created a novel way to communicate with one another, the moving picture, or as we now commonly know it, the movie.

There was nothing new with the type of language being used in the movie however; the movie simply presented a new medium to present verbal as well as visual language. Whereas previous media used to convey visual language might have been a canvas and paints of Michelangelo or the primitive camera and silver daguerreotypes of Mathew Brady, visual language could now be brought to the masses via the moving action camera and cellulose.

As time progressed, television technology emerged and brought the language of the image to the masses (Hoge, 1993). In the veritable blink of an eye, the manner in which humans communicated was changed forever. The debate over whether this change was positive or negative rages on and may never be clarified. However, the transformation from the written word to the language of the image as the most popular means of communication is a natural and positive progression toward the way in which humans most effectively communicate and understand. We are wired to understand this way, and we are wired to learn this way.

Literacy

The word literacy almost invariably sparks an assumption of the ability to read the written word, and rightly so; the word literacy originates from the Latin litera, which translates to "letter" in the English language (*Webster's New Twentieth Century Dictionary*, 1983). The written languages of humans are based on the letter, or a symbolic representation of a concept, as the least unit. Strings of these symbols create more complex symbols that in turn, represent some abstraction of a tangible thing. So, it is only logical that one associate literacy with the ability to read. But when the meaning of the word is more closely examined, an alternative definition can be found; to be literate not only means to have a command of the written language, it also implies a "…necessarily sufficient" degree of education and knowledge in any given area (*Webster's New Twentieth Century Dictionary*, 1983).

With this in mind, the application of the word as well as the concept of literacy can be wide-ranging. Central to this work is the application of the concept of literacy to visual language. Thus emerges the foundation of visual literacy (Adams and Hamm, 2000). This is the ability to perceive, interpret, and connect images in order to create meaningful knowledge and understanding from them. Humans are constantly bombarded with visual information cues that require the innate ability to understand and create

coherent meaning. In this way, it can be said that no one is illiterate; all who have the benefit of vision (and some who do not) have at least some ability to understand and interpret visual cues.

Within the last quarter of the twentieth century, the focus on visual literacy has begun to sharpen. With the continual emergence of film and television, this process seemed inevitable. As we progress from the baby boom generation, to the me generation, to the x-generation and beyond, abilities in visual literacy seem to be increasing. In fact, with the onset of the digital age in the late twentieth century, humans have entered an entirely new realm of communication that requires not only a highly developed sense of traditional literacy but also a finely tuned ability to interpret visual language. Thus, the development of visual literacy along with traditional literacy is imperative in the further development of human communication in the twenty-first century.

Communicating with Images

Now, that an orientation has been provided to the background and development of the language of the image I will explore the use, efficacy, and power of the image. Since

the birth of the moving picture in the late nineteenth century, film has been used to convey specific messages in a concise and deliberate manner. Think of any provocative film. What images come to mind? Why are these images so provocative and powerful? Why do these images create emotions and perhaps even a sense of urgency to act on them? The answers to these questions hold the keys to the understanding of visual language.

To illustrate the sheer power of the image, consider the billions of dollars that are spent each year on advertising; visual imagery intricately designed to make humans think or act in a certain way. Perhaps the reasons for the efficacy of such visual approaches are deeply rooted in our early development when we relied heavily upon vision for our very survival. Or perhaps the human mind is simply designed to react to images in a certain way. There is no doubt however, that film and other visually oriented communication media are very powerful tools.

Film as a Teaching Tool

Throughout the last quarter of the twentieth century, many instances of the use of film for various purposes as well as speculations as to its usefulness in education can be

seen (e.g. Cox, 1983; Kohl, 1978; Shelton, 1975). At first, film was used to teach, and then we began to teach about film. Today, this drive is still seen, manifest in the teaching of film critique and analysis. This field is very important and plays a critical role in acting as a lens by which to examine how students use film to create knowledge.

Within the past few years, educators and theorists have begun to explore the use of student produced film in education (e.g. Burn and Reed, 1999; Ferraro, 1989). The underlying theory is that as students produce a film, they will create a more authentic learning environment in which the knowledge that they freely generate is construed in a more personalized fashion. This notion is deeply rooted in the student-centered Constructivist framework.

Many progressive educators teach within the Constructivist framework. Ironically however, the use of student-produced film as a teaching tool is not widespread in the Constructivist classroom. Educators often use film to teach with, but rarely do they allow students to use the medium in order to capture and describe their thoughts and knowledge. Recently, researchers and practitioners have

broken new ground in the use of student-produced film as a teaching tool. Although the work in this field is fledgling, student-produced film has already begun to show promise (Schmid, 2002; Yerrick and Ross, 2001).

Considerations and Directions for the Future

Much however, is still to be understood about the efficacy of the use of student-produced film as a teaching tool. Because visual communication media, including film and television, are so widespread and effective in conveying messages, why not explore the use of a medium that makes use of knowledge, literacies, and ways of understanding that students already possess?

Perhaps one reason some educators may balk at a move towards the use of visual media in teaching is that it represents a shift from the traditional pedagogical role of the teacher toward a new educational ideal. A teacher using student-produced film invariably has less control over the learning fate of his students than does a teacher who uses, for example, an expository teaching methodology. But, this shift is the very essence of inquiry-based learning, one of the tenets of Constructivist teaching and learn-

ing. It has been well established through the work of some of the greatest educational theorists such as Piaget and Vygotsky that students receive a more meaningful educational experience if they are the directors or their own educational fates. The use of student-produced film makes this possible.

By no means am I suggesting an all-out shift to an exclusive use of film as a teaching tool; indeed, quite the contrary. Film should be used as a way to allow students an opportunity to present their ideas in a format that they find most understandable and enjoyable. What is most certain to emerge in this environment is a greater sense of ownership over the material as well as a more in-depth understanding and retention of key concepts and ideas.

Others reluctant to consider the use of film in the classroom may cite technological literacy issues with either their students or themselves. This is a very important issue to consider but is easily conquered. The students of today are usually highly skilled in the use of new technologies. Even if they do not possess the necessary skills to operate the equipment used to produce a film, they can learn together quickly and will benefit greatly from this collaborative learning

(Schmid, 2002). This type of cooperative learning environment falls within the Constructivist framework of teaching and learning.

Teachers not skilled in the use of filmmaking equipment also have many resources. Many companies that produce filmmaking software and hardware offer much support to teachers interested in expanding their horizons. In addition, many organizations exist that can offer guidance, ideas, and peer support.

A last issue to consider is the time and resource investment required for a student produced film project. No matter how one chooses to produce a film (e.g. digital, traditional, animated), the time commitment is enormous. Often, teachers are not blessed with limitless time. Also, budgets are tight and the equipment necessary is not usually found in the average classroom. Equipment can be expensive (especially for top of the line items) but in this age of rapid technology turnover, prices are quickly falling. For teachers wishing to implement digital filmmaking into their curriculum, a system capable of performing the necessary tasks (computer, software, digital video camera) can currently be purchased for around two thousand dollars.

The Art and Promise of Film

One can attempt to learn about art, but will miss the very essence of what it is all about. In the same way, one may simply learn about any subject but most certainly will miss the very soul of the subject. Ideas and concepts, just like art, are best experienced, rather than learned. When students are allowed to truly experience a subject, they are given the opportunity to begin to shape their own ideas and opinions as well as their own unique knowledge framework, which they can build upon in the future.

Student-produced films are one vehicle that can be used to assist students in becoming more interactive with a subject and thus become an active participant in their own education. There is still much territory to explore in the field before any concrete teaching methodologies can be devised. The pioneers in this emerging field have a great distance to go and a great deal to learn before student-produced film is a common fixture in the classroom. Once it is however, the possibilities for education using visual media are virtually limitless.

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In his life outside of education, Jason enjoys hiking, SCUBA diving, camping, kayaking and spending time with his wife, Karen, 3 dogs, 3 cats, and bird. May 2002 will bring with a baby Schmid, Jason and Karen's first child.

Advantages of Dual Processing

Jonathan Guy for Dr. Daniel Wilson
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The Apple Power Macintosh G4 with dual processors was introduced at MacWorld Expo on July 19, 2000 in New York (Apple Debuts New Power Mac G4s with Dual Processors, 2001). Apple was the first company to introduce a two-processor computer into the mainstream public. With both processors active, the computer can deliver seven billion calculations per second. The dual processor model, running at 500 MHz, can process data just as fast as a two-600 MHz Pentium III's, when running applications such as Adobe Photoshop. This article will explore the advantages of the multiprocessor technology, how it works and how it compares with single processor models.

Multiprocessing Hardware

A multiprocessor computer takes advantage of two or more processors. Multiprocessing technology is not new to the Apple Corporation.

In 1996 they released the Power Mac 9500 and the Power Mac 9600 (Snell, 2000). The Power Mac 9500 had two 180MHz PowerPC 604e processors and the Power Mac 9600 had four 180MHz PowerPC 604e processors.

Some processors lend themselves better to multiprocessing than others; the ones that do require relatively less work writing hardware and software to enable multiprocessing (Reed, 2000). When they were released, the 9500s and 9600s were very effective, but the development of the G3 single processor surpassed them in speed. The 604e processor was designed to be a capable multiprocessing component, but the less powerful PowerPC 603 was not. Like the Power 603 the G3 processor will never be paired with a second processor. The G4 processor, on the other hand, was designed in the mold of the 604

processor, and as such is multiprocessing capable (Reed, 2000).

Cache Advantages

The single largest problem in designing multiprocessing is keeping the cache or caches in agreement with data in main memory or hard drive memory. The cache is essentially a holder, or storage area, for the most often used data. To speed up processing time, the processor will access the cache, which is physically closer to the processing chip, rather than the RAM (Random Access Memory). The Apple 604 based multiprocessing systems had one central cache located on the motherboard. The new G4 processors have two caches, one directly built into each processor (Reed, 2000). The cache is only a copy of data stored in the main memory. As a result, any changes made to the data in the cache need to also be made to the main memory (Reed, 2000). The dual processor design requires protocols to keep the data in caches and main memory in sync, because the processor can access cache data so much faster than data in the main memory.

These protocols provide communication schemes from one cache to another. The absence of the protocol will result in the two

different processors working on the same data, negating any benefit. The protocol MEI (Modified, Exclusive, and Invalid) is used in the 63 and the 603 processors to maintain cache coherency among a single cache, a single processor, and main memory. The G4 and 604 processors use the MESI (Modified, Exclusive, Shared, and Invalid) protocol, which can manage data transfer among multiple caches, multiple processors, and main memory. An advantage of the G4 multiprocessing unit is that it supports three different cache coherency protocols. The MEI and MESI protocols allow for more communication among multiple processors and caches.

Furthermore, the G4 supports on-chip *snooping*. This describes what happens when the chip supervises bus traffic to further enhance cache coherency (Reed, 2000).

Hardware is only part of what a multiprocessing system needs to run at full potential. Multiprocessing systems require an operating system that can manage interactions among the multiple processors and applications (Snell, 2000).

Multiprocessing Software

The old symmetry that the Power Mac 9500 and 9600 were using

Figure 1: Tests performed by MacWorld					
	Gaussian blur 10	Unsharp Mask 2.3	Resize 50%	RGB to CYMK	Arbitrary Rotate .3
Power Macintosh OS 9 G4-450 (Dual Processor)	11.9	11.1	6.0	22.7	13.2
Power Macintosh OS 9 G4-450 (Single Processor)	18.9	17.4	9.5	25.2	21.4
Power Macintosh OS 9 G4-500 (Single Processor)	16.0	15.4	8.4	22.3	18.2

was called *asymmetric multiprocessing*, designed by Apple and DayStar. With this design, the operating system designates one chip as the main processor and the other chip as secondary. The secondary processor is responsible for managing an application that has been specifically written to support the multiprocessing system. For example when used with Adobe Photoshop, the secondary processor would handle most of the load of resizing an image, and the primary processor would save the image (Reed, 2000).

The new G4 operating systems, Mac OS 9 and Mac OS X, both support symmetric multiprocessing as opposed to asymmetric (SMP). In this new symmetry design all of the processors are treated equally and the operating system functions to automatically thread tasks to

any available chip. Any application that supports Apple's 5MP will make threads as it runs. These threads are channeled by the system to the CPU that has available bandwidth to perform the operation. One benefit of this new symmetry design is that operations that once took over the Mac's operating system halting all other operations (like burning a CD) can now be performed in the background (Reed, 2000).

Advantages of Dual Processing

Users of both Photoshop 5.5 and 6 can really benefit from the G4 dual processor. Photoshop's multiprocessing support works on roughly three hundred commands; anything from filters to color corrections. *MacWorld* lab tested the G4 dual processor, reporting the infor-

mation in their 07/28/2000 issue. In these tests performed by *MacWorld*, the dual processor outperformed the single processor in all categories except for the conversion from RGB to CYMK, where it lost by four tenths of a second. The most impressive accomplishment was using Cinema 4D XL 6.1 on the dual processor Mac. A 640 x 480 pixel model was rendered in almost eight minutes while this processor intensive function took fourteen minutes on a single processor 500MHz G4 (Snell, 2000). Photoshop results are in seconds (see Figure 1).

Present Options

As of this writing, the Power Macintosh G4 dual processor comes in several configurations, but the machines are fundamentally the same. The Power Mac G4 dual processor running at one gigahertz is available with level two cache at 256 kb. A one processor model running at one gigahertz is also available. It also comes with 80 GB of Ultra ATA hard drive space and a SuperDrive DVD-R and CD-RW. This machine comes with a NVIDIA GeForce4 MX video card with 64 MB DDR SDRAM, a V.90 modem and 10/100/1000 BASE-T Ethernet. One of the new features is the wireless networking option, this is a built in antenna and card slot for the optional AirPort. The PCI slot can be expanded to four full length 64 bit at 133MHZ. Some machines are being sold with both Mac OS 9.2 and the new Mac OS X.

Conclusion

The future of the Power Macintosh G4 dual processor computers is looking bright, but a few things need to happen to take full advantage. First, developers will need to code their applications to take advantage of Mac OS X's symmetric multiprocessing. Mac OS X is tailor made for dual processing. With this new operating system, two 500MHz processors will really perform the same as a one-gigahertz system because the OS will be able to push both of those processors to their limits (Reed, 2000). At this moment, it is worth waiting for the Mac OS X to come out with the dual processor because for the OS 9 the differences in speed are just subtle. The OS X operating system will take full advantage of dual processing capabilities and will run at 1.5 to 2.5 times faster than a single processor, making the added investment worthwhile in production situations.

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What is Premedia?

Mengtsung Tai for Dr. Charles Johnson
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Introduction

Today, more than ever, printing is being driven by customer demands. Customers continue to challenge the field by asking for high product quality, quick turnaround, variable data printing, cross media applications, and color. Premedia is a new innovation that holds promise for meeting these demands.

Premedia

Traditional prepress involves preparing pages with graphics and text ready for print. However, today's printed material often has to take on additional forms. This is often called repurposing or cross media applications. For example, data in printed documents often need to be placed on the Internet, on CD-ROM, and even on outdoor signs. This is especially true with advertising, where customer exposure is increased by showing your advertisement on different

media. For example, you see ads and commercials for Coca Cola in all sorts of media.

Premedia can be defined as the design of communication material, in digital form and with visual and sometimes audio elements, to be published in a variety of media (Costello, 2001). For example, if a

design includes a photo, then the photo may need to be a different resolution for different applications. The photo may need to be a very high resolution for a magazine, but much lower resolution for the web. So, premedia involves taking these variables into account while creating the elements of the design.

The premedia workflow is more complex. A page formerly designed for printing on paper using a traditional offset-lithography press may now be printed on a digital press with variable data, published on a website, shown on a PDA or a cellular phone, or burned onto a CD-ROM. Different output devices

Figure 1: Traditional prepress workflow and premedia workflow
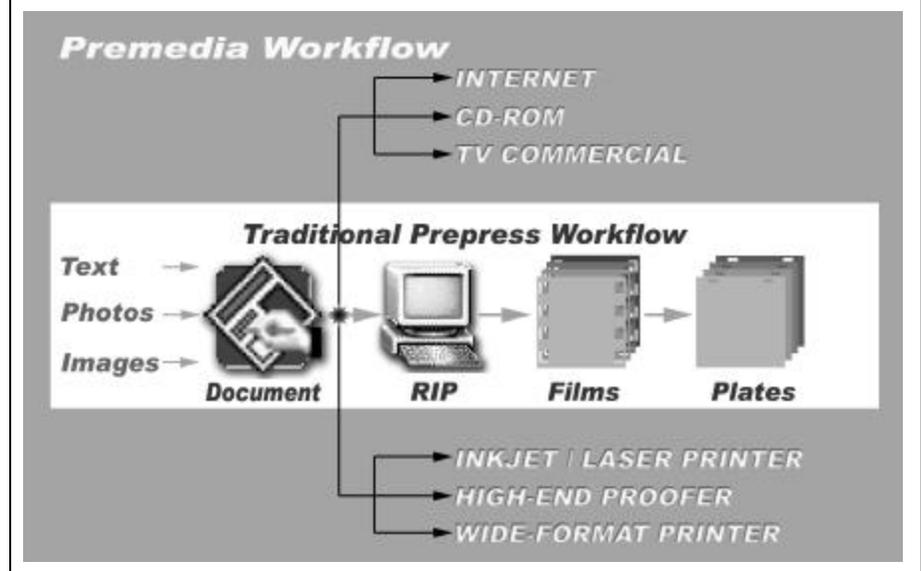
have different design requirements. Color ranges and image resolutions vary by device, so a design for an RGB monitor may be different than a design for an LED display on a laptop or a PDA, and different from ink or toner. However, Eastman Kodak expects to see its trademark displayed on all of these media with exactly the same yellowish gold, and Coca Cola expects to see its pop cans with the same color on all media around the world.

Summary

Premedia involves design of communication with different media in mind. It is in its infancy, but will quickly evolve as more people understand its capability. It will ultimately save time and money so will be a part of tomorrow's graphic communications workflow.

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Only members in good standing of the International Graphic Arts Education Association, Inc., or students of IGAEA members, may publish in the *Visual Communications Journal*.

Audience

Write articles for educators, students, graduates, industry representatives, and others interested in graphic arts, graphic communications, graphic design, commercial art, communications technology, visual communications, printing, photography, journalism, desktop publishing, drafting, telecommunications, or multi-media.

Present implications for this audience in the article.

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The *Visual Communications Journal* accepts four levels of articles for publication:

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Prepare manuscripts according to the APA style, including the reference list.

Submit a maximum of ten word-processed, 8.5" X 11" pages (excluding figures, tables, illustrations, and photos).

All articles *must* be submitted in electronic form and as a hard copy. Articles can be submitted on a 3 1/2" disk, Zip disk, CD-ROM, or as an e-mail attachment.

The text should be submitted in the Microsoft Word format. *Do not* submit documents created in page-layout programs.

Call out the approximate location of all tables and figures in the text. These call-outs will be removed by the editor.

List your name and address on the first page *only*! Article text should begin on the second page.

Artwork

You may submit either digital artwork or hard copies. Electronic artwork is preferred. Place all artwork files and/or hard copies with the first submission.

If you choose to submit only hard copies of artwork, send clean, crisp, camera-ready artwork (lines and figure text *must* be solid black).

Identify all hard-copy artwork on the back with your name, brief article title, and figure number.

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Scan photographs at 300 ppi resolution. Scan line drawings at 800 ppi resolution. Screen captures should be as large as possible.

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