

*"Genius without  
education is like  
silver in the mine."*

*B. Franklin*

**Visual Communications Journal**  
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# Visual Communications JOURNAL

## SPRING 2008

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\* ...Chris Lantz served as a juror for the *Journal*, but did not review his own paper.

\*\* ..Jerry Waite served as the editor of this *Journal*. However, his article was submitted blindly to the review committee.

# Editor's Note

by Jerry J. Waite, Ed.D, University of Houston

This issue of the *Visual Communications Journal* has something for everyone involved in graphic arts and graphic arts education.

Dr. Richard Adams presents the first of two papers related to teaching digital photography for print. This installment focuses on why it is important to teach digital photography in graphic arts programs, the equipment an instructor needs in order to effectively teach digital photography, quality control issues to emphasize, and types of shots that students should be able to make. This article, which grew out of a presentation Rick made at the IGAEA Conference at Rochester Institute of Technology in 2007, was particularly influential to me as my team and I redesigned our old process camera darkroom into a digital photography studio. I hope that you will find Rick's article equally as compelling.

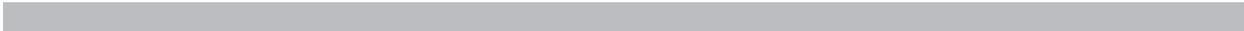
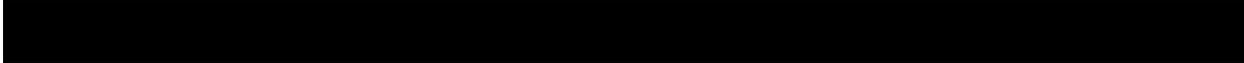
In their article, Dr. Daniel Wilson and his colleague Adam Burke provide both graphic arts faculty and professional print managers with some very valuable information related to what customers need to know in order to make the best use of Web-to-Print technologies. As I reviewed the completed list, presented in order of importance, it struck me that these competencies are extremely similar to those needed to simply design a job that will be digitally printed. By way of example, the most important competency identified for Web-to-Print customers is understanding image resolution. Other important com-

petencies include setting up proper bleeds, understanding that RGB is not the same as CMYK, and embedding fonts. Sound familiar, do they not?

Teachers involved in K-12 education should take particular note of the article written by Drs. Jeremy Ernst and Aaron Clark. These two faculty members conducted a study of the differences in perception between males and females when studying information and communication technology. In comparison to females, males demonstrate a higher level of interest in the study of graphics and think that they have a firm grasp on how to use graphic-related computer software. The researchers concluded that special emphasis should be placed on targeting females early in K-12 environments in order for them to develop a greater appreciation and competence for using graphical tools.

Thank you to the *Journal's* Editorial Review Board. I truly appreciate the time and effort invested by Cynthia Gillispie-Johnson, James Tenorio, Zeke Prust, Bob Chung, Malcolm Keif, Chris Lantz, and Mark Snyder.





# Digital Photography for Print

by Richard Adams, Ph.D., Ryerson University

If you have visited a prepress facility lately, you have probably noticed that the scanner, if present at all, was either not operating, covered up, or relegated to the basement. This reflects the current trend in image capture: digital photography (Figure 1).

Over the past decade, digital photography has come to replace scanning as a method of image reproduction. There are many books about digital photography but, other than Milburn and Carroll's (1997) study, none specifically for graphic arts professionals. The objective of this paper is to start a discussion on identifying topical areas that graphic communications students should know about photography, in order to achieve optimum image reproduction, without necessarily exploring the creative side of photography. The approach used was to define some of the common types of photographic shots, or scenes and setups, that would be appropriate for graphic reproduction. These shots are used to introduce specific technical concepts pertinent to each shot or to reproduction photography in general.

## Equipment for Teaching Digital Photography

Since the cost of digital cameras has declined dramatically in the past few years, a small digital photography studio can generally be set up for less than \$1,000 and does not require a significant amount of space.

**Panoramic view of Que-NET Media's digital photography studio in Toronto, Canada. The company now uses digital photography for almost all image capture in its catalog production. (Courtesy of Que-NET Media.)**



Figure 1

**Camera.** A digital SLR camera of 6–10 megapixels currently costs around \$500–1,000 and is adequate for teaching. While commercial studios may use medium-format cameras and large, expensive digital backs, the same concepts can be taught with a low-cost DSLR camera. Digital backs used with view cameras can, however, be used to teach effects achievable with a movable lens board, such as perspective changes.

Students should know how to calculate the number of megapixels required for a particular shot. For example, how many megapixels are required for a photo that is to be taken for a 8.5×11-in. magazine cover that will be printed at 150-lpi screen ruling? Conversely, students should be able to calculate the maximum reproduction achievable with a camera that has a specified number of megapixels. For example, how large an image can be obtained from a 6-MP digital camera if the image is to be reproduced at 150 lpi? (Figure 2, Sidebar 1 on next page.)

## Calculating Camera Megapixels and Image Size

**Lights.** Available lights include quartz halogen “hot lamps,” strobes, and mini-fluorescent “cool lamps.” Cool lamps are safe to handle and easy to transport, but do not produce as much light as strobes. Both hot lamps and cool lamps provide continuous lighting, which makes the scene easier to visualize through the camera's viewfinder than strobe lighting. The advantages of safety and continuous lighting make cool lamps well suited to teaching;

Printed images require sufficient megapixels to support their resolution and screening. This diagram shows the relative sizes of various megapixel images in relation to an 8.5x11-in. page (white dotted outline), which requires 8.5 MP for full coverage.

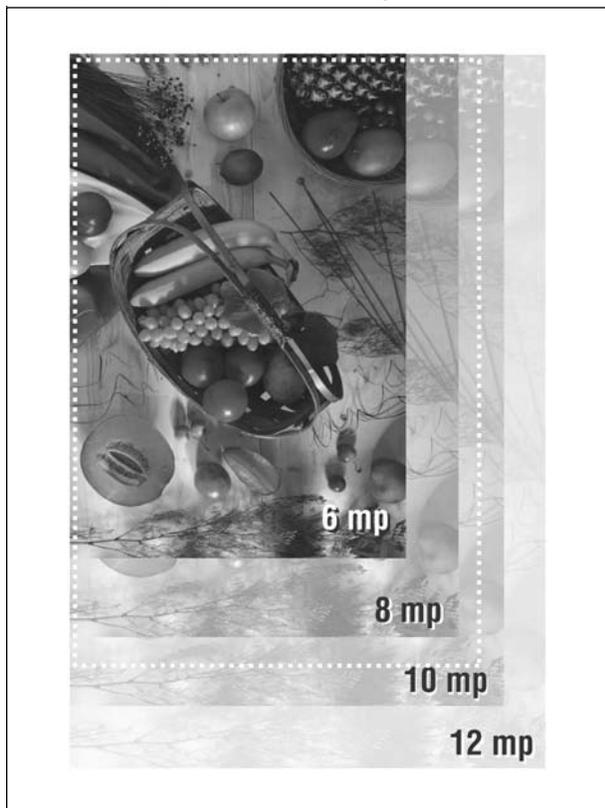


Figure 2

instructors need not worry about students touching hot lamps, and continuous cool lamps enable the shot to be viewed through the camera.

**Tripods and Stands.** A tripod is necessary for holding the camera steady on the floor or on a table top. This is important for portrait, product, and still-life shots. A copy stand or macro stand (Figure 3) is essential for macro and copy shots to hold the camera steady and with the camera back parallel to the copy surface.

**Quality Control Targets.** An 18% gray card (see Figure 4a) is useful for metering exposures. The camera is set to manual mode, and the shutter speed and aperture are adjusted to produce an EV of 0 when the meter is pointed at the gray card. A colorimetrically neutral white (Figure 4b) or gray card is essential for setting white balance, which neutralizes the scene lighting to the subject. A reflective gray-

### Calculating Megapixels Needed

Use this calculation to determine the number of megapixels needed for a certain-sized image, such as an 8.5x11-in. magazine photo.

1. Determine sampling ratio (e.g., 2:1, 1.5:1, 1:1). Sampling ratio is the number of digital image pixels used per halftone dot in the printed reproduction. According to the Nyquist theorem of sampling, a ratio of 2 pixels (vertical and horizontal, or 4 total) is considered optimum for conventional halftone-dot printing.
2. Calculate ppi needed:  $\text{ppi} = \text{screen ruling} \times \text{sampling ratio}$
3. Megapixels per sq.in. =  $\text{ppi}^2$  (e.g.,  $300^2 = 90000$  pixels = 0.09 MP)
4. Multiply MP/sq.in. by image size (e.g., for an 8.5x11-in. photo,  $0.09 \text{ MP} \times 8.5 \times 11 = 8.5 \text{ MP}$ ).

### Calculating image size you can get from your camera

Use this calculation to determine how large an image you can get from your digital camera, for example, a 6-MB digital SLR.

1. Determine ppi needed using the sampling ratio as described above. For example, a 150-lpi halftone reproduction at a 2:1 sampling ratio requires 300 ppi images.
2. Calculate number of MP per sq.in. (e.g.,  $300 \text{ ppi}^2 = 90,000$  pixels/sq.in. = 0.09 MP/sq.in.)
3. Divide camera MP by MP/sq.in. to get available sq.in. (e.g.,  $6 \text{ MP camera} / 0.09 = 66.67$  sq.in. of image area)
4. Take square root of available image area to get image size, e.g., square root of 66.67 sq.in. = 8.16 in.
5. So a 6-MP digital camera will give you an image 8.16 x 8.16 in. at 300 ppi.
6. Convert the image size to the proportion you want. For example, a to convert an 8.16 x 8.16-in. square image to an 8 x 10 proportion, multiply 8.16 x 10/8 to get 9.1 in. high, then multiply 8.16 x 8/10 to get the 7.3-in. width. Thus a 6-MP image in the proportion of 8x10 would be 7.3 x 9.1 in.

#### Sidebar 1

scale is useful for copy shots to ensure that the tonal range from highlight to shadow is captured. A color profiling target such as the X-Rite Macbeth ColorChecker SG (Figure 5) can be used to create a custom ICC profile for the camera.

## QC Concerns Common to All Shots

When teaching digital photography as a reprographic medium and as part of a graphic communications curriculum, the same emphasis on quality control, image fidelity, and consistency can be emphasized as in scanning (Table 1) and documented in books such as Adams (2002) and Molla (1988). In the 1980s and '90s, a systematic approach to scan-

A copy stand is useful for macro and copy work as it holds the camera with the back parallel to the copy surface.



Figure 3

An 18% gray card, such as this X-Rite Macbeth Gray Card, is useful in setting camera exposure. A white card, such as this Macbeth White Card, can be used to set the camera's white balance. Both cards are colorimetrically neutral; the gray card can also be used for setting white balance.

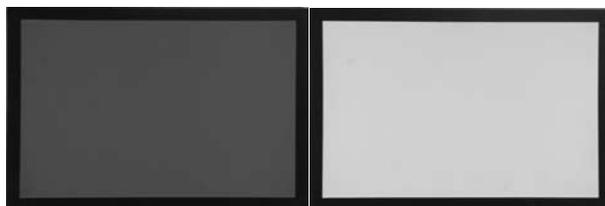


Figure 4

ning was developed to help operators get the optimal reproduction on the first scan, and to get the same results from multiple scanners and operators.

**File mode.** Most digital SLR cameras can capture images in JPEG or Camera Raw file format. JPEG files are processed in the camera. Camera Raw files are processed after downloading by another program. Image-processing programs include those provided by the camera manufacturer, Adobe Photoshop with the Camera Raw plug-in, and third-party applications such as Iridient Raw Developer, Phase One Capture One, Bibble Labs' Bibble Pro, and others.

**Exposure.** The exposure on a digital camera is very important in reprographic work. Unlike the "3-point" control characteristic of scanners, the camera's exposure

An ICC profiling target such as the X-Rite Macbeth ColorChecker SG is useful in making a custom ICC profile of the camera, similar to ICC scanner profiles. The profile helps match color to the original.

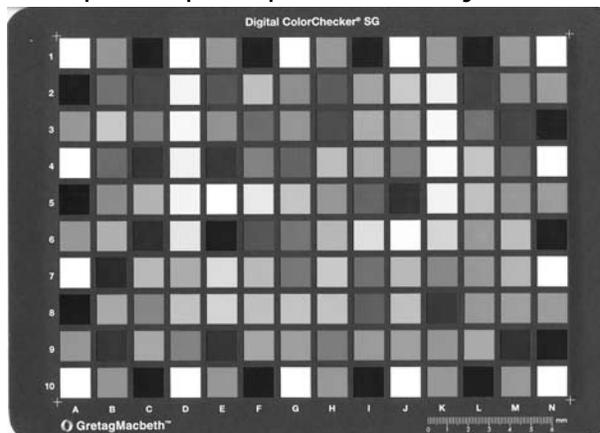


Figure 5

#### Scanner Concepts Applied to Digital Photography

	Scanner	Digital Camera
Tone Reproduction	3-point control: set image highlight and shadow to largest and smallest printable dots; set midtone to copy key and dot gain	1-point control: set exposure on 18% gray card to midtone; set highlight and shadow in image-editing program
Gray Balance	Select CMY dot percentages to produce neutral gray on press	Set camera white balance to neutralize lighting
Color correction	Adjust color hue and saturation with CMY inks in RGBCMY original colors	Select camera output ICC profile (sRGB) or Adobe RGB; or apply custom ICC profile

Table 1.

provides only one point of control. When set to an 18% gray card, the camera captures the midtone of the subject (Figure 6). The same is true when an external incident or reflective light meter is used to calculate the exposure.

To properly prepare a digital photo for print, an image-editing program is necessary to set the highlight and shadow to the smallest and largest printable dots, respectively, of the printing process, as would be done with scanning.

Industry practice in exposure setting may vary from the theoretical process outlined above. For example, Owen Colborne, digital photography technical specialist at QUE-NET Media in Toronto, said, "Most digital photographers set exposure by trial-and-error based on the previous shot.

A digital camera is a type of 3-dimensional scanner, but has only one control (exposure), not the 3-point control of scanners. Using an 18% gray card, exposure is used to set the midtone of an image.

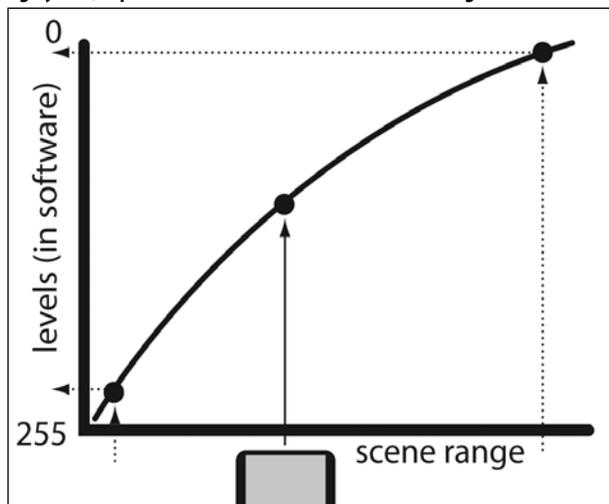


Figure 6

Exposure is based on achieving printable highlight values where needed. Then capture values for shadows that print with detail and color are checked and the level of fill light necessary to achieve this is added to the shot.”

Today’s digital SLR cameras feature a variety of exposure modes, in addition to manual (the user selects the aperture and shutter speed). These include aperture-priority (the user selects the aperture, and the camera selects the shutter speed), shutter-priority (the user selects the shutter speed, and the camera selects the aperture), and programmed (the camera selects both the shutter speed and aperture). Cameras may have various manufacturer-specific programmed exposure modes, as for portraits, landscapes, or closeups. Even though many students have their own digital cameras, the different exposure modes may be confusing to those who are accustomed to point-and-shoot cameras with automatic settings.

**White balance.** White balance compensates for the lighting and adjusts the photograph to be neutral gray. White balance is achieved with a white or gray card, which should be colorimetrically neutral (see Figures 4a and 4b).

White balance in digital photography is comparable to gray balance in scanning. In scanning, the operator adjusts the proportions of cyan, magenta, and yellow to achieve

neutral gray throughout the tone reproduction curve. In the camera, white balance adjusts the scene to neutral gray.

**ICC Camera Profile.** An ICC profile helps adjust the colors of the capture to match those of the original scene. A target with multiple color patches (Figure 5) is photographed, then the resultant file is imported into a profiling application. The application compares the colors of the captured target with the target’s actual color, and calculates a profile to compensate. ICC camera profiling will be covered in Part 2 of this article. Which will be submitted to the *Visual Communications Journal* in the near future.

**Camera Output Profile.** Most digital cameras can be set to output JPEG files to a standard working space. Of the two most common spaces, Adobe RGB is larger than sRGB (Figure 7).

Most digital cameras can be set to output JPEG files to one of several ICC standard working spaces, typically sRGB or Adobe RGB, as with this Pentax K100D SLR.



Figure 7

Macro shots are useful in graphic communications for photographing small products and items for catalog production, scientific illustration, technical documentation, and other uses. A macro stand to hold the camera and 1:1 macro lens are useful.



Figure 8

In digital photography, the ICC camera profile is comparable to selective color correction in scanning. In color correction, the operator adjusts cyan, magenta, and yellow inks in original image colors to achieve accurate hues and realistic saturation levels. In the camera, the ICC profile corrects colors to be true to the original scene.

**Color Workflow.** Generally digital photographers will want to view their captures on-screen and see the file's true color. This requires a calibrated, profiled monitor. Printing color to an output device also requires a printer profile to ensure that the output matches the original file.

## Types of Shots

In some cases the graphic arts educator may wish to distinguish between “reprographic” photography, as used to capture images for later reproduction, and “artistic” photography, used as an aesthetic medium. Based on their use in print service providers and as replacements for scanning, several types of photographic shots, or scenes and accompanying setups, could be considered important in reprographic photography and thus suitable as assignments or lab exercises in a graphic arts curriculum. These include macro,

copy, product, still-life, and portrait shots. Definitions, equipment, and key concepts are presented in Table 2.

**Macro photography.** Macro photography refers to extreme close-ups (Figure 8) as might be required for scientific and technical photography, education, training, documentation, or small product photography. Macro photography requires a macro lens, a special lens designed for close-up photography, or a zoom lens with macro capability. How close the lens can focus is usually described as the reproduction ratio. For example a 1:1 macro lens can capture an image on the camera's sensor that is the object's actual size. A 2:1 macro lens can capture an image that is half the size of the original.

**Copy work.** Copy work refers to images captured of flat work for reproduction (see Figure 3). Examples include logos, photographs, paintings and other artwork. For best results, illuminate copy evenly, with lights at a 45° angle to the copy surface to eliminate glare.

**Product photography.** This is photography of small to large items for reproduction in catalogs, newspapers, brochures, flyers, ads, signs, internet auctions, and other

**Types of Digital Camera Shots for Reprographic Photography**

Shot type	Purpose	Equipment Needed	Key Concepts
Macro	shoot close-ups of small products, parts, or components	macro lens macro or copy stand cable release lights	Macro shots require a high depth of field necessitating high f/stops and bright light
Copy Shot	reproduce an existing piece of reflective artwork or graphic	macro or zoom lens copy stand with 45° illumination cable release grayscale	the ability to reproduce the color and tone of an existing graphic requires precise exposure through the use of a light meter or gray card, along with a grayscale to ensure that the full range of highlights and shadows are captured.
Product Shot	capture a photo of a single product or group of products of table top size, e.g. for eBay ad	zoom lens tripod cocoon-type light diffuser lights	Proper light diffusion is important for a product shot, to ensure that the viewer can see all sides and details of the product.
Still Life	capture an aesthetic shot or group of products or items	zoom lens tripod lights backdrop	An ICC camera profile is important when photographing color to ensure that color in the capture matches that of the original scene.
Portrait	capture a photograph of a person or small group, e.g., to go with a biographical paragraph, team poster, campaign flyer, etc.	zoom (short telephoto) lens tripod lighting backdrop	A short telephoto lens and diffuse lighting are necessary to give the best perspective on the human face.

Table 2

reproduction methods (Figure 9). Depending upon the size of the item, various lighting accessories may be used, including light tents, diffusers, and natural lighting.

**For product photography, as used in catalog production or product illustration for online auctions, a light diffuser like the Bowens “Cocon” is useful.**



Figure 9

**Still-lives.** Refers to collections of subjects, whether set up on a table top or on the floor. Examples include artistic groupings of objects or groups of complementary accessories for catalog photography (Figure 10).

**Still-life photography is useful in illustrating catalogs, magazines, brochures, and reports. A zoom lens is useful in framing the scene.**



Figure 10

**Portraits.** Portraits refer to posed (vs. candid) photos of people, individually or in groups. Examples include yearbooks, biographical head-and-shoulders “mug shots,”

and group photos of people. Generally faces reproduce best when photographed with a short-range telephoto lens, as in the 70–120-mm focal length. A telephoto lens compresses distance from front to back, which often flatters the face.

**Architectural.** This refers to photographs of buildings and rooms (Figure 11), including photography for real estate brochures and catalogs as well as furniture, decorative accessories, and interior design. Architectural photography can benefit from a wide-angle lens, which captures a wider view of the scene than a normal lens.

**Landscape and scenery.** This category includes outdoor and scenic photography, as might be used in travel or recreational magazines, catalogs, and brochures.

**Architectural photography, which usually calls for a wide-angle lens, is used frequently in graphic communications, as for example in real estate brochures, catalogs, and magazines and in promotional materials.**



Figure 11

## Conclusion

Digital cameras are essentially three-dimensional scanners and have become the primary mode of image capture in graphic communications. To be equipped to work with digital photography, graphic communications students should know about different types of digital cameras, equipment and accessories necessary to take shots most commonly encountered in graphic communications, and quality control concepts and procedures including tone reproduction, gray balance, and ICC profiling.



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*This is a juried article.*



# Customer Competencies for Success in Web-to-Print Environments

by Daniel G. Wilson, Ph.D., Adam A. Burke, Illinois State University

## Introduction

Some level of knowledge is required of customers preparing and submitting digital print-ready files via a web portal when using Web-to-Print technology. This study was developed to identify skills necessary for customers to participate successfully in a Web-to-Print environment in the graphic communications industry. In order to achieve a successful clientele relationship, organizations may need to identify where a customer's knowledge base and skill sets fall short within the Web-to-Print environment and develop training to meet these needs. This research was aimed at identifying those competencies critical for success.

Previous research has identified the most common preflight problems (Pfister, 2004). While these problems reflect competencies that are lacking in many who prepare digital layouts for print, they are not necessarily specific to Web-to-Print environments and may not reflect all of the potential problems that those implementing Web-to-Print systems will likely encounter with customer knowledge gaps.

## Background

An increasing number of graphic communications service providers (GCSP) are allowing customers to interface with digital production processes through a Web portal in a process commonly called Web-to-Print. Organizations in the graphic communications industry have multiple solutions for offering this technology. The Web portal solutions include purchasing space on a hosted site, purchasing Web-to-Print software and maintaining a site, or assigning human resources of the organization to develop and maintain a site. There are two broad categories of Web-to-Print solutions: (1) template-based systems and (2) upload-based systems. Template-based systems offer the customer pre-designed layouts of commonly ordered products, like business cards, stationary, forms, and greeting cards. Customers may customize the piece, choose among production options, and be issued a quote. Upload-based systems allow the customer to log-on to the Web-to-Print interface, choose production specifications,

and upload files that are ready for printing (Shaffer, 2006). The use of the Internet and Web portals requires customers to assist in the production process: this is known as customer participation. A strategic path must be envisioned on how an organization will interact with the customer (Halbesleben & Buckley, 2004). A proactive relationship must be formed since customers will be replacing some of the planning and premedia resources of the organization (Llopis et al., 2006).

Web-to-Print allows a customer to submit jobs to a GCSP with minimal interaction with employees of the company. Web-to-Print offerings add value to the customer relationship (Pellow et al., 2003c). Customers are able to order and reorder print jobs, proof and approve documents, acquire templates, check usage reports, and acquire invoices (Pellow & Sorce, 2003a; Pellow et al., 2003c; Zipper, 2006). Allied to Web-to-Print is another market niche relatively new to printers called digital asset management (DAM); this involves the GCSP storing, organizing, and maintaining customer document files including textual content, images, and multimedia in a Web accessible database (Austerberry, 2004). Web-to-Print services allow customers to access and manipulate these assets. These kind of services add further value to the interaction between the client and organization, but also requires a customer-training plan. The first step in identifying where customer training is needed is to assess the components of Web-to-Print technology with which the customer will have to interact (Llopis et al., 2006).

Globalization and digital printing have created greater competition in the graphic communications industry. Since printing technologies are offered worldwide, competition revolves around price, turn-around time, and quality in the value-added services (Savastano, 2006). The growing demand for deliverables to stand out and draw attention through personalization has also encouraged growth of the digital print market (Kapel, 2005). A recent study suggested that out of the 340 firms interviewed, 67 offered full service and fully customized digital printing with a total investment of \$900,000 (Sorce & Pletka, 2004). Web-to-Print services will assist in automating and optimizing these digital workflows.

## Significance of the Study

The advent of Web-to-Print depersonalizes the customer relationship with the GCSP due to the lack of face-to-face contact. Therefore, to maintain and strengthen relationships, the GCSP may benefit by identifying and eliciting new avenues of communication for supporting customers. One type of interpersonal contact in a Web-to-Print environment revolves around the training and education needed in a Web-to-Print environment. By identifying core competencies required of customers in the preparation and submission of print media files, the GCSP will be better able to arrange for training and support needs required for successful customer interaction.

The study aimed to identify and rank customer job preparation and submission skills critical in a Web-to-Print environment. The results will provide those GCSPs adding Web-to-Print services with important information on where to focus training and education services. As a large portion of the responsibility has shifted from the service provider to the customer, the GCSP will benefit from identifying the specific competencies required of their customers in the Web-to-Print process. These necessary competencies can then be fostered through training and educational services.

## Research Design

A modified Delphi technique was used to generate the data for this study. The design of the study employs a panel of experts to generate items and come to consensus on the relevance of the items. The Delphi technique utilized is considered “modified” because the initial list of knowledge and skills required of prepress professionals was identified from the literature (Pfister, 2004). This assisted in establishing a point of reference in the opening round of questioning in the Delphi study. Although an initial competency list was provided in the study, participants determined which competencies might be included as important in the final list and added subsequent items critical in the Web-to-Print environment.

The techniques employed in this research identified a consensus on the relative importance of competencies required of customers in a Web-to-Print environment. The panel utilized for the study was made up of experts

in the management of Web-to-Print technologies. Potential panel members were identified by Julie Shaffer, Director of the Digital Printing Council (DPC), a division of the Printing Industries of America/Graphic Arts Technical Foundation (PIA/GATF). Fifteen panel members were selected and seven members (46.6%) participated in all three rounds. After a consensus was reached, the researcher ranked the competencies to identify the relative importance of each specific competency identified. This process was done through calculating the mean scores for each item.

Previous research had identified preflight procedures required of those who compose graphic layout files for print in a digital prepress environment (Pfister, 2004). While these competencies are not specific to Web-to-Print environments, they do form a baseline of technical competencies that may be similar to those required for success in Web-to-Print environments. Although the preflight items in the Seybold Study (Pfister, 2004) reflect competencies required in job submission, there is no assurance that these same competencies will be required in a Web-to-Print environment. However, participants in the modified Delphi study had the opportunity to rate these job submission competencies as unimportant if this was the case.

The modified Delphi technique used multiple rounds of expert collaboration to identify and rate a customer job preparation and submission competency list pertinent to digital printers utilizing Web-to-Print technologies. The number of rounds in the design depended upon the point at which a consensus was reached among participants on the panel (Helmer, 1966). Consensus for this study included a set of criteria set forth by the researchers. Competency skills receiving a mean rating below 3.5 were extracted from the consequential rounds of questioning. Furthermore, two forms of measurement were utilized to determine consensus of competencies critical in a Web-to-Print environment. The stability or consensus of the group is based upon the mean of a particular competency between rounds (Volk, 1993). Stability is considered less than an average of 15% change between the total competencies between rounds two and three (Scheibe et al., 1975). The second form of measurement used to determine consensus was standard deviation. When there was a decrease in standard deviation between rounds two and three, the study was considered stable.

## The Instrument

A Web-based questionnaire was used to facilitate data gathering. Although there were multiple rounds of questioning, each questionnaire was similar in format. A five-point Likert-type rating scale was used to rate each individual competency. The calculations for determining the importance of each competency in a Web-to-Print environment were derived from the ratings of Very Important (5); Important (4); Neither Unimportant Nor Important (3); Slightly Important (2); and Unimportant (1). An open-ended question followed each rated competency for participants to elaborate, if desired. Also, an open-ended question followed the competencies. This question asked participants to add additional pertinent competencies to the list. Space was also provided for elaboration in this section. After each round, the researcher compiled the data and posted responses anonymously for all participants to read and reiterate or change ratings as desired.

## Data Analysis

Consensus among participant responses and rounds was determined from two methods of measurement. The first measurement used the mean average for each competency (see Table 1). In total, if the average mean for the given competencies changed less than 15%, the selected competencies were considered valid. The second measurement used to determine consensus was the comparison of standard deviations between the competencies deemed as critical to Web-to-Print in the second and third rounds. If the average standard deviation between the second and third round declines a consensus is determined. Statistical consensus was obtained after the third round. For this study, the average standard deviation of the second round was 0.828 and the average standard deviation of the third round was 0.752. (See Table 1 on page 16)

In total, 21 competencies were identified through statistical consensus as critical for customers to interact effectively in a Web-to-Print environment. These competencies primarily centered around production-oriented skills, though many also focus on an understanding of the printing process. Ranking the competencies determined as necessary in Web-to-Print was the next analysis done to determine the key competencies important for customers in Web-to-Print. Competencies receiving the same

mean value were rated as equally important to each other. Thus, the rankings came out to seven levels, or ranking categories according to mean values. (See Table 2 on page 17)

The competencies defined in the study encompassed all Web-to-Print systems. To gain more useable data specific to the type of Web-to-Print system being employed, the competencies were divided into two categories: (1) those relating to upload-based systems, and (2) those relating to template-based systems. Table 3 identifies which competencies were considered to be critical in which type of Web-to-Print category. Because the nature of template-based systems is to minimize uploading of data, there are far fewer issues with regard to production skills. However, there are still several key issues identified that may need to be considered when implementing this type of service for customers. (See Table 3 page 18)

## Discussion

The twenty-one competencies generated from this research supports the notion that customer participation is becoming increasingly important within the graphic communications industry. To gain a better understanding of the 21 competencies, four broad categories can be identified to classify these essential tasks of Web-to-Print. The first category relates to the process of file preparation. This includes the ability to properly embed fonts in PDFs that are submitted, the ability to compress a set of files as a ZIP archive, knowing how to package or organize files for a non-PDF job, using PDF presets to generate press-ready PDF files, and knowing how to set-up a clean flat database in Excel. Depending upon the organization and the Web-to-Print system utilized, these competencies could vary in complexity. For example, the variations of PDF have expanded the ability of this digital file to include metadata and various levels of quality depending upon the version or type utilized. Therefore, it is important for the organization to relate to the customer how they want this file to be compiled.

The second category is the process of document preparation. This category includes the ability to submit files with proper image resolution, the ability to set-up proper document size and bleeds, an understanding of transparency and how it may not print as displayed, the ability to set-up proper crossovers and page numbering, understanding image resolution issues and the negative effects

of upsampling, an understanding of lossy compression (JPEG) and how it could impact quality, an understanding of copyright issues, and understanding the difference between vector files and bitmap files. These competencies are known as design considerations. With page layout, image editing, and illustration software being more readily available, a greater number of people outside the graphic communications industry are designing their own products. Therefore, the GCSP must assist the cus-

tomers in identifying design techniques that may or may not work properly prior to production of the document. This concept is becoming increasingly significant, as designed pieces are being multi-purposed for use on the Web and in print.

The third category associated with the Web-to-Print competencies is the ability to properly identify and utilize various color management skills. This includes an under-

#### Comparison of Web-to-Print Competency Areas Means Between Round Two and Three

Competency Areas	Round 2 Mean Response	Round 3 Mean Response	Percent Change
The ability to submit files with proper image resolutions	5.000	4.857	2.86%
Ability to set-up proper document size and bleeds	4.714	4.857	2.94%
An understanding that colors could look different when viewed on a monitor compared to CMYK on substrate	4.714	4.857	2.94%
The ability to properly embed fonts in PDFs that are submitted	4.571	4.857	5.88%
Plan proper panel/page imposition for a folded product	4.571	4.571	0.00%
An understanding of transparency and how it may not print as displayed	4.571	4.571	0.00%
Know how to package (or collect for output) to organize files for a non-PDF job	4.571	4.429	3.12%
Understand image resolution issues and the negative effects of upsampling	4.571	4.143	9.37%
Understand appropriate paper choices and how these will affect the look and functionality of a job	4.429	4.286	3.23%
The ability to compress a set of files as a ZIP archive	4.286	4.571	6.25%
Know how to set up a clean flat database in Excel	4.286	3.714	13.33%
Know the difference between spot colors and builds	4.286	4.000	6.67%
Understand how coatings will affect the look and functionality of a job	4.286	3.857	10.00%
Understand the difference between vector files and bitmap files	4.286	4.286	0.00%
An understanding of copyright issues	4.286	3.714	13.33%
For multiple page documents ability to set up proper crossovers and page numbering	4.143	4.286	3.33%
Understand basic types of binding and their applications	4.143	4.000	3.45%
Understand how to separate a job into multiple order elements and explain how the job ties together (i.e. arch folds inserted and binding from multiple files)	4.000	3.429	14.29%
An understanding of lossy compression (JPEG) and how it could impact quality	3.857	4.000	3.57%
Using PDF presets to generate press-ready PDF files	3.714	4.286	13.33%
Using proper color mode (CMYK versus RGB)	3.714	3.714	0.00%
Know how to create CMYK separations or spot builds without exceeding acceptable total ink limits	3.714	3.571	3.85%

Note: The average percentage of change for the competencies is 5.53.

Table 1

standing that colors could look differently when viewed on a monitor compared to CMYK on substrate, knowing the difference between spot colors and builds, using the proper color mode, and knowing how to create CMYK separations or spot builds without exceeding acceptable total ink limits. In order for customers to properly define the colors of a product, the organization must assist the customer in identifying the crucial colors of the piece and determine the output device on which the product will be submitted.

The fourth category on which customers must be trained is the actual process of print production. This category includes understanding appropriate paper choices and how these will affect the look and functionality of a job, understanding basic types of binding and their applications, understanding how coatings will affect the look and functionality of a job, and how to plan proper panel/page imposition for a folded product. Relating these competencies to the customer could include bringing the customer onto the production floor to see how these processes work or thoroughly explaining these techniques through samples of previously printed pieces.

As the process of Web-to-Print progresses, technological advancements could automate some of these competencies, requiring less interaction with the customer. Through discussion provided by the panelists, knowing how to separate CMYK documents and RGB to CMYK conversion is already becoming a lesser issue as output devices have begun to automate these tasks. Color management skills could also change drastically into a universal system where colors will properly display on computer and on print. The process of PDF production could also become nonexistent if global standards are put into place for the production of document files. However, in comparison to prior competencies required within the industry, the issue of file types is becoming less problematic as compatibility between software programs is growing. Advancements in template-based Web-to-Print systems, with more complex templates put into place that define document bleeds and folding instructions for production, could eliminate some of the print production knowledge needed. Automation of actual document preparation competencies would require advancement within the design phase of production through page layout, image editing, and illustration software.

With the inclusion of customers into the production process, legal and liability issues may also be of concern to

### Competencies Critical to Web-to-Print Production as Determined by Members of the Delphi Panel

Rank	Competency Area
Level 1	The ability to submit files with proper image resolutions
Level 2	Ability to set-up proper document size and bleeds
Level 2	An understanding that colors could look different when viewed on a monitor compared to CMYK on substrate
Level 2	The ability to properly embed fonts in PDFs that are submitted
Level 3	Plan proper panel/page imposition for a folded product
Level 3	An understanding of transparency and how it may not print as displayed
Level 3	The ability to compress a set of files as a ZIP archive
Level 3	Know how to package (or collect for output) to organize files for a non-PDF job
Level 4	Understand appropriate paper choices and how these will affect the look and functionality of a job
Level 4	Understand the difference between vector files and bitmap files
Level 4	For multiple page documents ability to set up proper crossovers and page numbering
Level 4	Using PDF presets to generate press-ready PDF files
Level 5	Understand image resolution issues and the negative effects of upsampling
Level 5	Know the difference between spot colors and builds
Level 5	Understand basic types of binding and their applications
Level 5	An understanding of lossy compression (JPEG) and how it could impact quality
Level 6	Understand how coatings will affect the look and functionality of a job
Level 6	Know how to set up a clean flat database in Excel
Level 6	An understanding of copyright issues
Level 6	Using proper color mode (CMYK versus RGB)
Level 7	Know how to create CMYK separations or spot builds without exceeding acceptable total ink limits

Table 2

the GCSP and customer. Guidelines need to be established prior to production in order to manage risk and ensure responsibility on the outcome of the product. Organizations must assist the customer in properly setting standards for quality as well. Digital image files submitted with a low image resolution or that are compressed to an extent where the image loses its quality is an issue that needs to be addressed. If the customer is unsatisfied with the outcome of the product, where is the line drawn for customer responsibility and organization responsibility?

Customers cannot be blamed for not properly submitting digital files if the proper procedures were not first communicated to the customer. Loyalty and positive relationships may be built within the graphic communications industry through improved communication and training. This could be done through project-based environments where employees of the organization are centered on specific clientele. But it must be remembered that customers are not part of the organizational culture and reorganization may be in order to properly identify and meet customers' training needs (Du Gay & Salaman,

### Competencies Broken Down Into Two Web-to-Print System Categories

	Upload-based W2P Systems	Template-based W2P Systems
The ability to compress a set of files as a ZIP archive	X	
The ability to properly embed fonts in PDFs that are submitted	X	
The ability to submit files with proper image resolutions	X	X
Plan proper panel/page imposition for a folded product	X	
Ability to set-up proper document size and bleeds	X	
Using PDF presets to generate press-ready PDF files	X	
Using proper color mode (CMYK versus RGB)	X	
For multiple pages documents, ability to set up proper crossovers and page numbering	X	
An understanding that colors look different when viewed on a monitor compared to CMYK on substrate	X	X
An understanding of transparency and how it may not print as displayed	X	
An understanding of lossy compression (JPEG) and how it could impact quality	X	X
Understand basic types of binding and their applications	X	X
Know how to package (or collect for output) to organize files for a non-PDF job	X	
Know how to set up a clean, flat database in Excel	X	
Know the difference between spot colors and builds	X	
Understand appropriate paper choices and how these will affect the look and functionality of a job	X	X
Know how to create CMYK separations or spot builds without exceeding acceptable total ink limits	X	
Understand how coatings will affect the look and functionality of a job	X	X
Understand image resolution issues and the negative effects of upsampling	X	X
Understand the difference between vector files and bitmap files	X	
An understanding of copyright issues	X	X

Table 3

1992). Furthermore, new communication avenues must be examined to assist customers with production methods (Llopis et al., 2006). For example, information relating to the submission of digital files can be translated to the customer through Web-based training sessions, video conferencing, telephone communication, face-to-face meetings, and help desks located within the actual Web-to-Print system itself. If appropriate procedures and knowledge-building resources are communicated properly, there is a greater chance of successful completion of a job without error (Halbesleben & Buckley, 2004).

## Summary

GCSP have the ability to take these critical competency skills and apply them to practice within their organization through training and orientation of customers to Web-to-Print technologies. Whether the GCSP is using upload or template based Web-to-Print systems, the competency list generated in this study can be used as a guide for deciding on how to train potential or existing customers. Processes will need to be put into place to identify what competencies customers will need to training for, how customers will be trained, and how the organization will handle the process of integrating customers into the production process. Planning for the introduction and implementation of Web-to-Print systems is essential for success with the system. Production techniques need to be reevaluated and analyzed in order to define how the customer is going to interact. This study used a panel of experts with experience in Web-to-Print systems to identify key customer competencies. This critical knowledge can serve as a starting point for developing on-line or face-to-face training and information sources to help smooth the implementation of Web-to-Print systems in graphic communications businesses.

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# Differences in Perception between Male and Female Students When Studying Information and Communication Technology

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## Introduction

Public schools in the United States traditionally place educational worth on core content areas. Escalating accountability demands from state and federal legislation are prompting schools to closely assess the performance of learners in core content and skill-based areas (Dieckmann, 2004). Content centered on information and communication technologies (ICT) can also be employed to achieve educational value in schools (Mulkeen, 2006). ICT, with the development of digital technologies, is having a vast impact on the economic composition of the United States. ICT has had a major social impact in that it has altered the method in which the world acquires information. "There is an emerging need for all sectors of society to find ways to optimize the opportunities which ICT presents (Gurstein, 2000)."

Incorporating communication technologies into the K-12 curricula not only prepares students for society and the world of work but also supports their learning engagement. A study conducted on the impact of instructional content and design suggests that incorporating the study of communication technology provides engaging learning experiences that involves students as active participants in learning (Yoon, Ho, and Hedberg, 2005). Transmitting technical and scientific information through the use of imaging and design graphics permits the integration of core content in foundational subjects with ICT. Conveying information through the use of graphs, charts, illustrations, maps, and symbols increases content awareness (Bernstein, 1999; Capraro et al, 2002; and Hardin, 1993). Applying design and visualization concepts to mathematical and scientific data provides heightened abilities to understand information (Ki and Klasky, 1997).

Understanding the importance and distinct benefits of representative imagery through the study and application of ICT raises numerous topics of interest about the current state of student understandings and perceptions of the communication of technical and scientific information. To assist in addressing these interests, a Student Graphical Communications Survey has been developed for students in grades 6-12 in a standards-based curriculum for technology education.

## Rationale

The National Science Foundation awarded a grant titled VisTE (Visualization in Technology Education) to a group of researchers in technology education. This grant was designed to produce instructional materials that were standards-based for the inclusion of technological literacy in grades 6-12. The VisTE project produced 12 units of instruction, with each unit covering a topic that is scientific or technologically based. Students study these areas while at the same time learning good visual communications related to the topics addressed. Each unit begins with introductory materials to aid in visual skill development and then progresses to advanced activities that are student-driven. Each unit requires students to communicate technical and scientific information through a variety of ways and through multiple target markets. Major visual science areas of study within this project include the understanding and creation of 2-D and 3-D models. Students also learn the differences between data-driven and conceptual modeling alongside the intended standards-based content. The materials were designed to give students knowledge and skill in developing visualizations related to technical and scientific information for grades 6-12. Over the next four years, these materials were piloted in K-12 classrooms throughout the United States. During the process of piloting, the researchers for this project felt a need to gather more information about students' interests and capabilities in areas related to visual communications. Working with the outside evaluator, Research Triangle Institute, directional statements were developed and validated concerning students' interests and capabilities as it relates to using visual techniques to communicate technical and scientific information.

## Methodology

A list of school survey locations was compiled by site response to a national call for research participants. Of those that responded, 14 locations were selected from the pool of teacher participants. The participants were contacted to confirm their interest in participating in the educational research survey and were mailed the Student Graphical Communications Survey. The 14 selected sites were from ten states: Oregon, Ohio, Arkansas, South

Carolina, North Carolina, Connecticut, Oklahoma, Virginia, Texas, and Pennsylvania. The selected research sites were composed of seven middle schools and seven high schools. The survey was administered to 510 students from these 14 locations across the United States to provide an analysis of student understandings, perceptions, and interest in graphical communications via scientific and technical visualization. The student participants are all enrolled in technology education courses that are currently implementing communication-based curricula, VisTE, either at the middle or high school levels. The surveys for the 14 locations were returned to the researchers where the data was compiled and analyzed.

## Student Graphical Communications Survey

The Student Graphical Communications Survey was developed to provide insight to six research interests. The first research interest was: “Do students understand the ways in which graphics are used to communicate technical and scientific information?” The first interest question was posed in an attempt to assess student recognition of graphical intent. The second research interest was: “Do students find it interesting to study the uses of graphics to communicate technical and scientific information?” The second interest question was employed to investigate the attractiveness of graphics as an area of study concerning technical and scientific based representation. The third research interest was: “Do students feel competent in using technology to design graphics to communicate technical and scientific information?” The third interest question was used to investigate perceived technological proficiency regarding graphical design for technical and scientific based representations. The fourth research interest was: “Do students feel that it is of importance to study how to design graphics to communicate technical and scientific information?” The fourth interest question was used to assess student perception of the significance of design graphics in technical and scientific areas. The fifth research interest was: “Do students have a desire to learn more about using technology to design graphics?” The fifth interest question focused on interest through a perceived measure of student aspirations of further studies related to graphical design. The sixth research interest was: “Do students feel that they possess an understanding of how to use computer technologies to design graphics that communicate technical and scientific information?” The sixth interest question was used to measure student perception of computer proficiency pertaining to graphical design.

The Student Graphical Communications Survey (Appendix A) was developed to provide insight into student perceptions, understandings, interests, competencies, values, and desires for each of the six research interests. The student participants were prompted to respond in the form of a Likert Scale. The Likert Scale provided response levels for each survey statement that best matches students’ current perceptions, understandings, interests, competencies, values, and desires.

The survey was coded with a nine-digit number to identify student participants by a sequence of numbers rather than personal identifiers. General participant demographic information was also collected using the Student Graphical Communications Survey, such as participant grade and gender. Instructors provided the researchers with the geographical categorization (rural, urban, or suburban) of their school’s surrounding city. This measure was put in place to ensure regional accuracy.

## Demographical Information

The 510 participants range from sixth to twelfth grade with the majority of participants concentrated around seventh and eighth grade (Table 1). Student participant gender was determined to be predominately male, constituting 60 percent of the total students surveyed (Table 2). There is a notable variation in the geographical location of the students surveyed (Table 3). Approximately one-third of the students are classified as rural, one-quarter are classified as suburban, and two-fifths are classified as urban. The student participants’ course instructors attained geographical information.

Participant Grade		
Grade	Frequency	Percent
6	55	11%
7	133	26%
8	196	38%
9	51	10%
10	18	4%
11	16	3%
12	15	3%
Unknown	26	5%

Table 1:

### Participant Gender

Gender	Frequency	Percent
Female	201	40%
Male	309	60%

Table 2

### Participant Geography

Grade	Frequency	Percent
Rural	172	34%
Suburban	118	23%
Urban	220	43%

Table 3

All grades, genders, and geographical regions are adequately represented in the 14 sites where the Student Graphical Communications Survey was distributed. The demographical information collected is indicative of the variable distribution for technology education in the United States based on information provided by the International Technology Education Association (L. Price, personal communication, December 05, 2006).

## Data Analysis

Comparative analyses were conducted for student participant responses. Summary statistics were generated to summarize the set of responses. Mean, variance, standard deviation, and standard error were calculated (Table 4). The mean indicates an average of responses of participants on the survey. The variance of the student participant responses gives a sense of how closely the distribution of responses is around the statement average. The variance range for the survey varies from 1.47 (statement four) to 2.45 (statement five). The smaller the calculated variance, the closer the individual responses are to

### Statements 1-6 Summary Statistics

Grade	n	Mean	Variance	Std. Dev.	Std. Err.
1	510	3.386275	1.895686	1.376839	0.060967
2	510	3.301961	1.53143	1.23751	0.054798
3	510	3.631373	1.891352	1.375264	0.060898
4	510	3.478432	1.4681	1.211652	0.053653
5	510	3.331373	2.453827	1.56647	0.069364
6	510	3.421569	1.874976	1.369298	0.060634

Table 4

the mean. The standard deviation of the responses provides information that indicates where the dispersion of responses falls given a standard average for each statement. The statement response standard deviations range from 1.21 (statement four) to 1.38 (statement one). Standard deviations around one indicate a narrow collective dispersion of response data. The analyses indicate low rates of variability and narrow dispersion within responses for all six statements.

Comparative analyses were conducted to identify differences in student understandings and perceptions of communicating scientific and technical information based on grade, gender, and geography. Using the Kruskal-Wallis Test, no statistically significant differences were found concerning student grade and/or geography based on perception of understandings and abilities. However, statistically significant differences in student responses on a number of items were uncovered when based on the variable "gender" that did not exist in the variables "grade" or "geography."

The Kruskal-Wallis Test is an alternative to the One-Way Analysis of Variance when the measurement scale assumption is not met or the two samples are related. Hinkle, Wiersma, and Jurs (1994) indicate that in the Kruskal-Wallis Test, the calculation of the test statistic considers the central tendency of the responses and the total distribution of the responses for both groups. The sampling distribution for the test statistic is used to test the null hypothesis against the alternative directional hypothesis. The calculated values for the test statistics are evaluated in comparison to the critical values to determine if the null hypothesis is rejected or if there is evidence that fails to reject the claim. If the value of the test statistic is less than the critical value the null hypothesis is not rejected; if the value of the test statistic is greater than the critical value the null hypothesis is rejected.

Similarly to the procedure followed in conducting comparative analyses for student grade and student geographic location, six null hypotheses were generated to test for significant differences between male and female student survey respondents:

1. There are no differences in male and female respondents' understandings of the ways in which graphics are used to communicate technical and scientific information (Table 5).
2. There are no differences in male and female respondents' interests in studying the uses of graphics to communicate technical and scientific information (Table 6).
3. There are no differences in male and female respondents' feelings of competence in using technology to design graphics to communicate technical and scientific information (Table 7).
4. There are no differences in male and female respondents' feelings of importance to study how to design graphics to communicate technical and scientific information (Table 8).
5. There are no differences in male and female respondents' desire to learn more about using technology to design graphics (Table 9).
6. There are no differences in male and female respondents' feelings of understanding how to use computer technologies to design graphics that communicate technical and scientific information (Table 10).

Tables 5, 6, 7, 8, 9, and 10 provide the results for the Kruskal-Wallis procedure when testing for differences between male and female participants. The statistical analysis controlled for the differences in the number of male (309) and female (201) participants.

**Kruskal-Wallis results: I have a good understanding of the ways in which graphics are used to communicate technical and scientific information in the real world.**

P-Value=0.0003

Gender	n	Median	Avg. Rank
Male	309	4	273.9207
Female	201	3	227.1816

Table 5

**Kruskal-Wallis results: I think that it is interesting to study how to use graphics to communicate technical and scientific information.**

P-Value=0.0003

Gender	n	Median	Avg. Rank
Male	309	4	273.9207
Female	201	3	227.1816

Table 6

**Kruskal-Wallis results: I think that I could get a good grade in a class that focused on using technology to design graphics that communicate information.**

P-Value=0.0003

Gender	n	Median	Avg. Rank
Male	309	4	268.54532
Female	201	4	235.44527

Table 7

**Kruskal-Wallis results: It is important for students to study how to design graphics to communicate technical and scientific information.**

P-value = 0.1672

Gender	n	Median	Avg. Rank
Male	309	4	262.44336
Female	201	4	244.82587

Table 8

**Kruskal-Wallis results: I would like to learn more about using technology to design graphics.**

P-value = 0.0001

Gender	n	Median	Avg. Rank
Male	309	4	277.86893
Female	201	4	221.11194

Table 9

**Kruskal-Wallis results: I have a good understanding of how to use a computer program to design graphics that communicate technical and scientific information.**

P-value = 0.0268

Gender	n	Median	Avg. Rank
Male	309	4	266.77185
Female	201	4	238.17165

Table 10

## Findings and Conclusions

Findings were made from student responses to the six statements addressed in the study. The calculated variance of the student participant responses uncovers how closely distributed the responses are around the average for each statement. The standard deviation of the student responses also indicates a concentration of responses by highlighting the narrow collective dispersion of student reporting of understandings and perceptions of the communication of technical and scientific information. Findings and conclusions based on the Kruskal-Wallis test are made using an alpha level of 0.05. Male responses when compared to female responses present statistically significant differences in perception of understanding ways graphics are used to communicate technical and scientific information. Also, male responses when compared to female responses present statistically significant differences in responses for showing interest in the study of graphics and how to communicate in technical and scientific areas. Male responses revealed a statistically significant difference in perception of competency in using graphics to communicate technical and scientific information. Significant differences between males and females were also seen in the area of desire to learn more about designing graphics concerning technical and scientific information, with males having the highest collective ratings. Overall, male student participants feel that they have good understandings of how to use computer programs to design graphics that communicate technical and scientific information. There are no significant differences between males and females when examining the importance of designing graphics to communicate technical and scientific information.

The researchers developed the following conclusions: overall, male student perception results demonstrate a higher understanding and interest in the study of graphics as they are used in technical and scientific communities. Males also feel that they have a firm grasp of computer software and how to use it to design graphics for communicating technical and scientific information.

## Recommendations

It is recommended by the researchers that more emphasis in the K-12 and college level classrooms be placed on how to use graphics to communicate technical and scientific information. Given the backgrounds of the authors of this study, the researchers feel that more activi-

ties need to be developed to include the use of graphics as a form of communication in the K-12 classrooms. Special emphasis should be placed on targeting females early in K-12 environments in order for them to develop a greater appreciation and competence for using design graphics tools to communicate technical and scientific information.

More research is needed in how to teach design for graphics in technical and scientific areas, especially reaching targeted populations such as females in K-12 environments. It is the belief of the researchers that more emphasis needs to be placed in the K-12 classroom as well as the post-secondary years in how to design graphics to be used to communicate technical and scientific information. This would include students understanding differences and proper techniques to convey this information, whether it is 2-D or 3-D, static or dynamic.

The authors of this study will use the findings to better establish a workable research agenda that will include additional studies in what effects visual abilities. Establishing a reliability measure for instruments used in determining visual skill and capabilities will be emphasized in the research agenda. The researchers will use the findings to better research and develop stimulating and appealing visual-based activities and curricula materials that will enhance student abilities. In conclusion, as we continue to progress in the 21st century, which many professionals consider the visual age, more emphasis is needed in how we teach our students to use visual communications.

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*This is a refereed article*

#### Appendix A: Student Graphical Communications Survey

We are interested in your opinions on information and communication technology. Therefore, we would like you to answer some questions on this subject. This is not a test, and you will not be graded on it. There are no right or wrong answers. Thank you for taking the time to complete this survey.

ID Code (teacher provided #): \_\_\_\_\_ - \_\_\_\_\_ - \_\_\_\_\_

What is your grade in school?	6th	7th	8th	9th	10th	11th	12th
Please select your gender.	Male			Female			

Please circle the number in the column that indicates how much you agree or disagree with the following statements.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1) I have a good understanding of the ways in which graphics are used to communicate technical and scientific information in the real world. (Some examples of graphics are graphs, charts, pictures, maps, and symbols).	1	2	3	4	5
2) I think that it is interesting to study how to use graphics to communicate technical and scientific information.	1	2	3	4	5
3) I think that I could get a good grade in a class that focused on using technology to design graphics that communicate information.	1	2	3	4	5
4) It is important for students to study how to design graphics to communicate technical and scientific information.	1	2	3	4	5
5) I would like to learn more about using technology to design graphics.	1	2		4	5
6) I have a good understanding of how to use a computer program to design graphics that communicate technical and scientific information.	1	2	3	4	5

## Manuscript Guidelines

### Eligibility for Publication

Members of the International Graphic Arts Education Association, 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 the audience in the article.

### Types of Articles

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

1. Edited articles are accepted or rejected by the editor. The editor makes changes to the article as necessary to improve readability and/or grammar. These articles are not submitted to a panel of jurors. The decision of the editor is final.
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3. Refereed articles are submitted to the editor and are distributed to jurors for acceptance/rejection. Refereed articles are original empirical research. Jurors make comments to the author and the author makes required changes. The decision of the jurors is final.
4. Student articles are submitted by IGAEA members and are accepted/rejected by the editor. These articles are not submitted to a panel of jurors. The editor's decision is final.

### Submittal of Manuscripts

All manuscripts must be received by the editor no later than December 15th to be considered for the spring *Journal* or by June 15th to be considered for the fall *Journal*. Include digital copies of all text and figures. Prepare text and artwork according to the instructions given in these guidelines. Be sure to include your name,

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- Submit a Microsoft Word document, maximum of 10 pages (excluding figures, tables, illustrations, and photos). Do not submit documents created in page-layout programs.
- Word document must have been proofread and be correct.
- Call out the approximate location of all tables and figures in the text. Use the default style “No Spacing” on these callouts. The call-outs will be removed by the designer.
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  - ◆ Heading 1
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## Graphics

- Be sure that submitted tables and other artwork are absolutely necessary for the article.
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- Set up tables in separate documents, one document for each table.
- Do not attempt to make it “pretty”, use the default Word style “Normal” for all table text. Do not use any other formatting.
- Do not use hard returns inside the table (“enter” or “return”)
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## Artwork

- Scan photographs at 300 ppi resolution.
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