2001

# A study of important content for undergraduate graphic communications programs

Tsung-Yu Hao
*University of Northern Iowa*

# INFORMATION TO USERS

This manuscript has been reproduced from the microfilm master. UMI films the text directly from the original or copy submitted. Thus, some thesis and dissertation copies are in typewriter face, while others may be from any type of computer printer.

**The quality of this reproduction is dependent upon the quality of the copy submitted.** Broken or indistinct print, colored or poor quality illustrations and photographs, print bleedthrough, substandard margins, and improper alignment can adversely affect reproduction.

In the unlikely event that the author did not send UMI a complete manuscript and there are missing pages, these will be noted. Also, if unauthorized copyright material had to be removed, a note will indicate the deletion.

Oversize materials (e.g., maps, drawings, charts) are reproduced by sectioning the original, beginning at the upper left-hand corner and continuing from left to right in equal sections with small overlaps.

Photographs included in the original manuscript have been reproduced xerographically in this copy. Higher quality 6" x 9" black and white photographic prints are available for any photographs or illustrations appearing in this copy for an additional charge. Contact UMI directly to order.

ProQuest Information and Learning
300 North Zeeb Road, Ann Arbor, MI 48106-1346 USA
800-521-0600

# A STUDY OF IMPORTANT CONTENT FOR UNDERGRADUATE GRAPHIC COMMUNICATIONS PROGRAMS

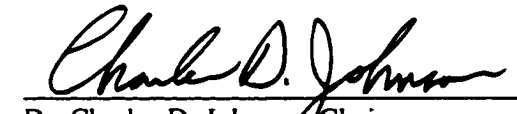
A Dissertation

Submitted in Partial Fulfillment

of the Requirements for the Degree

Doctoral of Industrial Technology

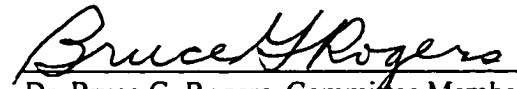
Approved:



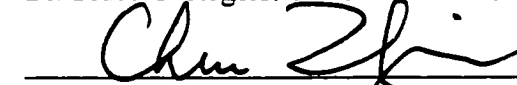
Dr. Charles D. Johnson, Chair

Dr. MD Salim, Co-Chair

Dr. Teresa J K Hall, Committee Member



Dr. Bruce G. Rogers, Committee Member



Dr. Joyce Zhuojun Chen, Committee Member

Tsung-Yu Hao

University of Northern Iowa

December 2001

UMI Number: 3035107

UMI Microform 3035107


ProQuest Information and Learning Company
300 North Zeeb Road
P.O. Box 1346
Ann Arbor, MI 48106-1346

# A STUDY OF IMPORTANT CONTENT FOR UNDERGRADUATE GRAPHIC COMMUNICATIONS PROGRAMS

An Abstract of a Dissertation

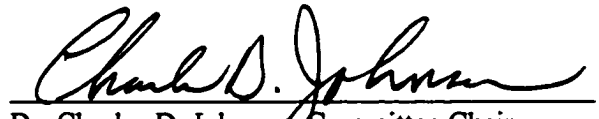
Submitted

in Partial Fulfillment

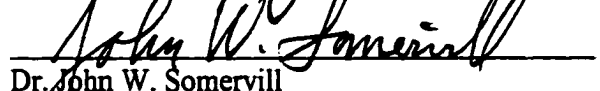
of the Requirements for the Degree

Doctoral of Industrial Technology

Approved:



Dr. Charles D. Johnson, Committee Chair



Dr. John W. Somervill
Dean of the Graduate College

Tsung-Yu Hao

University of Northern Iowa

December 2001

## ABSTRACT

This study was an investigation of important content for undergraduate graphic communications programs in four-year colleges and universities. The findings of this study can help educational professionals as they design curriculum, equip laboratories, and recruit faculty.

Subject categories and content items were initially identified by a review of literature. These content items were then further refined and rated on level of importance by a panel of experts. Modified subject categories and content items were then sent to the panel a second time for rating. Through this process, 15 subject categories and 68 content items were identified.

A questionnaire was developed based on the identified content items and this was sent to instructors teaching graphic communications courses in four-year colleges or universities. A total of 99 questionnaires were returned, a 63.5% response rate. Means for every content item and subject category were generated.

When rated by graphic communications faculty nationwide, all subject categories and content items were rated above 3.0 (moderate importance) with the exception of three content items. *Prepress*, *Basic Communication Techniques*, *Digital Printing Technology*, *Safety and Health*, *Production Management*, and *Graphic Design* were rated as the most important subject categories, while *Interpersonal Communications Skills*, *Oral Communications and Speech*, *Color Reproduction and Separation*, *Electronic Prepress (Publishing) System and Desktop Publishing System*, and *Lithography Process* were rated as the most important content items.

Statistical analysis was completed to determine if content items within subject categories were internally consistent. Cronbach's Coefficient *Alpha* was used to test the internal consistency of content items within each subject category. It provided support for keeping content items within each subject category except one which was *Graphic Communications Past and Future.*

A factor analysis was completed to determine if some subject categories could be combined. Using this process, five broader subject categories were created including *Business and Computers*; *General Graphic Communications*; *Graphic Design and Cross Media Publishing*; *Science, Mathematics, and Communication Skills*; and *Others.*

TABLE OF CONTENTS

PAGE

CHAPTER

PAGE

# LIST OF TABLES

TABLE PAGE

PAGE

# LIST OF FIGURES

FIGURE PAGE

# CHAPTER I

# INTRODUCTION

## Background of the Problem

The printing industry has been called a "sunset industry" by *Wall Street Journal* (Romano, 1997, p. 1), but the worldwide market does not reflect this. Printing sales are estimated to reach $1 trillion by 2004, up from $800 billion in 2000 in the world market ("Worldwide Printing," 2000). In the United States, printing and publishing remain a big business, with the United States being the world's largest printer and publisher as well as the largest importer and exporter of printed products ("Printing and Publishing," 1999). In addition, statistics in "Printing and Publishing" (2000) show that the United States is the world's largest market for printed products, with $178 billion shipped in 1998 within the country (estimate), $184 billion in 1999 (estimate), and $188 billion in 2000 (forecast). This data reflects that the printing and publishing industry is one of the top five industries in the United States (Romano, 1997).

Since the beginning of the 20th century, society has been changing at an ever-accelerating rate due to the rapid development of new technologies and innovations (Bobbitt, 1997). The printing industry has not been immune to these new developments, many of which have contributed tremendously to the printing business. While new technologies have resulted in great benefits to the industry, they have also necessitated a change in the nature of the workforce.

Like most manufacturing companies, printing companies require that employees possess the education and skills which enable them to use appropriate technologies to

perform effectively in the workplace (Markert, 1997). This is important because companies whose employees possess relevant knowledge and hands-on skills are better able to remain globally competitive (Winzeler, 1997).

In the last decade, the printing and publishing industry has recruited well educated and skilled employees from colleges and other educational programs but the printing industry is still experiencing trouble finding the qualified employees it needs (Dailey, 2000; Paparozzi, 2000; Roth, 1993; Webb, 1999b, 2000). Ratcliff (1997) states that there is a growing realization that the gap must be bridged between the content of graphic communications programs and the real life occupational needs of the graduates. Kuo and Deuermeyer (1998) state that a university program should feature subjects considered important to industry needs. A feasible program should be maximally effective and efficient so as to minimize the gap between college programs and industry needs (Ferren, 1997).

There are at least 132 graphic communications programs offered at community colleges or four-year colleges and universities in the United States to support the needs of printing and publishing industry (Flecker & Groff, 1998). These institutions offer associate degrees, bachelor's degrees, master's degrees, and even doctoral degrees in graphic communications with specialties in technology, marketing, education, or management.

An undergraduate program is the formal academic experience of students pursuing a bachelor's degree (Ratcliff, 1997). An undergraduate program is also "an intentional design for learning negotiated by faculty in light of their specialized

knowledge and in the context of social expectation and students' needs" (Toombs & Tierney, 1991, p. 21). As in any other field, graphic communications program designers must know the current requirements and trends in the field before designing an appropriate undergraduate program.

In addition, program designers also need to clearly define what a graphic communications program is. Below is a description of a graphic communications program from U.S. Department of Education's Classification of Instructional Programs 2000.

> A program that generally prepares individuals to apply technical knowledge and skills in the manufacture and distribution or transmission of graphic communications products. Includes instruction in the prepress, press, and postpress phases of production operations and processes such as offset lithography, flexography, gravure, letterpress, screen printing, foil stamping, digital imaging, and other reproduction methods. (Morgan & Hunt, 2000, p. 84)

From the viewpoint of graphic communications educators, undergraduate graphic communications programs should offer students general and theoretical knowledge for their future professional careers, not just vocational training (Farmer, 1997). Graphic communications programs may become obsolete if universities/departments only focus on short-term job training rather than on skills required for future job security and the long-term health of the industry as a whole (Goff, 1997).

Because of the previous description, it is obvious that graphic communications program content is very important (Bobbitt, 1997; Tobias, 1996). Content can be defined as specific types and areas of knowledge within a particular field of study (Martin, 1979). Changes in printing business and technology affect curriculum content in graphic

communications programs (Paparozzi, 2000). Some examples of emerging themes include the Internet, E-commerce, new communication technologies and skills, new business strategies, finance, and business sales, and business marketing and management.

A major influence on curriculum content is technology. Technology has become so pervasive that faculty members must continuously reassess its place in curriculum content (Farmer, 1997). As new technologies are integrated, the graphic communications program may take on new purposes, meanings, and a broader scope (Farmer, 1997). Educators must know how and where to locate new information and integrate new technologies and innovations into the graphic communications program (Ariza, Knee, & Ridge, 2000).

The ultimate goal of a graphic communications program is to provide the knowledge and skills students need to be successful in their chosen career (Kurian & Molitor, 1996). Therefore, the content of graphic communications programs is critically important.

## Statement of the Problem

The problem of this study is to determine the important content for a comprehensive undergraduate graphic communications program that meets the future needs of students, industry, and society.

## Statement of the Purpose

The purpose of this study is to use the opinions of educators to determine the content to be included in graphic communications programs for four-year colleges or universities to meet future needs. Educators must consider the ever-changing technology

in printing and publishing, and the need to bridge the gap between the theoretical and the practical. This is beneficial for developing appropriate curriculum (Wise, 1979).

This study provides information to graphic communications faculty about subject areas to teach, purchase of equipment, and future faculty recruitment. The findings of this study can help curriculum designers, developers, planners, and researchers in universities develop feasible and appropriate graphic communications programs for students and the industry.

## Statement of Need

The gap between the needs of the printing industry and the skills of university graduates has always existed. As a result, the printing and publishing industry is attempting to narrow this gap by pushing colleges to adopt/design new graphic communications programs because of the new technologies and innovations (Goff, 1997).

Another need for this study is based on labor trends. The labor market dilemma for college graduates will continue. According to the Bureau of Labor Statistics (BLS), there were about 250,000 more college graduates entering the labor force each year between 1986 and 1996 than there were new college-level jobs, a trend that is projected to continue until 2006 (Mittelhauser, 1998). The number of printing jobs will decrease gradually by 10,700 from 1996 to 2005 in the United States (Hecker, 1998). This will result in college graduates facing a more challenging job market. Therefore, it is important for graphic communications students to understand career options in their decisions and to obtain appropriate knowledge and comprehensive job skills in college.

In addition, there is a need to design new programs due to changes in society. College is a subsystem of society, and a department is a subsystem of the college. When society changes, it influences all levels of the college system. Skeel and Hagen (1971) state that the social subsystem of a college influences the behavior of its members (students, staffs, and faculty members) and the decisions they make regarding programs. Since programs play a vital role in a department, to retain high quality faculty and to recruit good students, they need to be re-examined due to the changes in departments, colleges, and society (Slaren, 1994). This implies that the graphic communications programs also need to be re-examined as well.

New computer and communications technologies require the latest technology in the graphic communications laboratory and classroom. This influences the way university faculty members think about teaching in graphic communications programs. Faculty members are continuously searching for information about new technologies that provide a better learning environment and increase the quality and efficiency of graphic communications education (Bobbitt, 1997).

## Research Questions

This study was based on the content of graphic communications programs in four-year colleges and universities in the United States as well as the opinions about the programs from active educators. The following research questions were addressed.

1. What content is important for undergraduate graphic communications programs as determined by a review of the literature and an Expert Panel?

2. By category and individual item within each subject category, what is the level of importance, as rated by graphic communications faculty, for content making up an undergraduate graphic communications program?

3. What is the evidence of reliability, as judged by the internal consistency, for each of the subject category scales?

4. What meaningful patterns can be found among the correlations of the subject category scales?

## Limitations

This study consisted of one questionnaire given to Expert panelists and one to graphic communications faculty. In designing this study, some limitations occurred, as delineated below.

1. Educators were instructed to examine the appropriateness of content items for a comprehensive graphic communications programs. It is possible for educators to have bias due to their professions and commitment in specific content areas.

2. Political, economic, and social changes influence graphic communications curriculum tremendously. However, in this study, these factors were not considered.

## Delimitations

The delimitations in this study are presented below.

1. This study focused on four–year colleges and universities in the United States providing graphic communications courses.

2. The survey questionnaire was based on the information from existing curricula, textbooks, dissertations or studies, and public and private organizations.

3. The five educators in the Expert Panel were limited to chairpersons, coordinators, or curriculum designers from graphic communications programs in Student Chapters of the Technical Association of the Graphic Arts (TAGA, see Appendix A).

4. The study focused on content items for United States graphic communications programs in the future.

## Assumptions

Some assumptions made it possible to conduct this study.

1. Educators who participated in the study were not concerned with equipment and budget constraints when rating content items.

2. Educators who participated in the study were actively teaching in graphic communications courses in four-year colleges or universities and were interested in curriculum development for their undergraduate programs.

3. Educators who participated in the study were capable of judging and evaluating content items in the graphic communications program.

## Statement of Procedure

### Research Instrument

Survey questionnaires served as the data collection instrument for this study. Questionnaires were sent to educators in this study via the U.S. postal service and e-mail with attachments. An on-line survey was also used. The mailed questionnaire is the main method used in this study because it has the advantage of privacy and convenience for participants at a relatively low cost (Balian, 1982; Dillman, 1978).

Two major instruments were used in the study: (a) the Expert Panel Questionnaire, and (b) survey questionnaire. Two rounds of the Expert Questionnaire were conducted. In round one, the Expert Panel Questionnaire was used to ask panelists to rate the content items and add or modify content items and subject categories. The second Expert Panel Questionnaire was used to ask for agreement and opinions on new subject categories and new content items based on the feedback from the first questionnaire.

After responses from Expert panelists were analyzed, a questionnaire was created for Graphic Communications faculty and a pilot test was conducted. The pilot test helped determine if the questionnaire was fully understandable. This information was used to improve the validity and reliability of the questionnaire and thus gain a better response.

A survey questionnaire was deemed to be an appropriate way to collect data for this study (J. P. Gall, M. D. Gall, & Borg, 1999). Not only is this "the most frequently used method of collecting descriptive information" (White, 1987, p. 79), but it can also be used to collect information about participants' beliefs, attitudes, interests, or behaviors.

A type of Likert-scale was used with five alternative choices of importance to measure educators' perspectives about the content items within subject categories for graphic communications programs.

Description of the Expert Panel, Pilot Test, and Population

Five experts were selected to participate in the Expert Panel from graphic communications programs with active Student Chapters of TAGA in the United States. These participants were coordinators, chairpersons, or curriculum developers, and they were also recommended by Kara Knopf, Assistant to the Director of TAGA.

Two educators, one coordinator of graphic communications program and one part-time instructor who works for industry, were used in the pilot test to examine the draft questionnaire. Both academic and industry opinions contributed to this study to increase reliability.

The final survey questionnaire was sent to every educator teaching graphic communications courses in four-year colleges or universities; approximately 156 faculty members. Their names were located through their departmental websites during the fall of 2000.

Data Collection

Data collection was divided into three phases. The first phase dealt with the response from educators in the Expert Panel using e-mail and the postal service. The second phase involved sending the draft questionnaire to two educators who were asked to review it as a pilot test. The revised questionnaire was then used for the last phase.

For convenience, graphic communications educators were given three options for filling out the survey questionnaire: (a) a hard-copy survey questionnaire mailed by postal service; (b) an e-mail message with the survey questionnaire as an attachment; and (c) an e-mail message that linked directly to the on-line survey questionnaire on the educators' personal websites.

Data Analysis

The statistical analysis was based on responses to the questionnaire from graphic communications faculty. The demographic data of graphic communications faculty was

first analyzed. Secondly, the importance of content items as rated by the Expert Panel and graphic communications faculty was studied.

The Cronbach's Coefficient *Alpha* was used to test the reliability (internal consistency) of those content items within each subject category. To reduce the number of subject categories, a factor analysis was conducted. Factor analysis is used to identify similar characteristics (patterns) in subject categories for possible combination into one subject category ("Factor Analysis," 2001; Gorsuch, 1974).

## Definition of Terms

The following terms are defined to clarify their usage in this study.

1. Expert Panel: a group of people who have special skill or knowledge in some particular field (Flexner & Hauck, 1993).

2. Curriculum: the subjects that are studied or prescribed for study as an educational plan of an institution, school, college, or department, or a program or course (Allen, 1990; Ratcliff, 1997).

3. Personal Questionnaire Website: a website for educators to participate in this study. Actually, every graphic communications faculty member has his/her own individual website. All the necessary information will be posted in the website.

4. Content: the matter dealt with in a field of study; the subject matter of a discipline or an educational course (Gove, 1981).

## Description of Succeeding Chapters

This dissertation consists of five chapters. Chapter I introduces the problem of the study and research questions. Chapter II is a review of the literature focusing on the

present and future of graphic communications, curriculum, research methodologies, and factor analysis. Chapter III includes the research methodology for this study, including the research design and instruments. Chapter IV concerns the research findings as well as data analysis for this study. Chapter V contains the summaries, discussion, conclusions, and recommendations.

# CHAPTER II

# REVIEW OF THE LITERATURE

## The Graphic Communications Industry

The printing industry has more manufacturing plants than any other industry in the United States (Romano, 1997). One decade ago, there were 65,000 printing establishments; by 1998, an estimated 70,000 printing establishments existed ("Printing and Publishing," 1999, 2000). Over 128 printing-oriented associations are based in the United States, excluding regional networking groups (Flecker & Groff, 1998). These statistics show that the printing and publishing industry occupies an important position in industry in the United States.

The development of printing is of crucial importance to many other societal functions since printing plays a major role in spreading information, knowledge, and ideas (Pacey, 1996). The general public probably does not understand the importance of the printing industry because it has been underrated and underestimated for its contribution to the production of knowledge and to civilization (Levenson, 2000). Most people simply take it for granted that printed material will always exist but rarely take note of the fact that the books, magazines, and newspapers they read are a result of advances in printing technologies.

The printing industry maintains its important role in society and continues to evolve just as civilization and humanity advance swiftly due to technologies (Bobbitt, 1997). From yesterday's world of mechanized labor to today's world of digital unification, the printing industry has sought to improve upon every advance and move

towards the goal of increasing efficiency and versatility ("Job Definition Format," 2000). The printing industry has rapidly and continuously adopted the newest technologies and applied them to practical production to produce the quality products that fulfill the needs of the general public and reach people in today's multimedia environment (Vision 21, 2000).

Printers can accept clients' jobs in digital format to get the printing jobs done right away. These kinds of requests have become acceptable, understandable, and relatively easy to accomplish. New technologies are helping the printing industry solve practical printing problems and improve the processes of production derived from scientific research or practical experience (Clark & Sugrue, 1990; Mitcham, 1994).

The printing industry is adding more computerized and automated systems, and the innovative use of equipment and processes will be the key to industry success (Vision 21, 2000). This is a challenging and never-ending issue for the printing industry, which has sustained tremendous pressure from customers for better quality, lower cost, and faster turnaround. This has forced the industry to take further steps in adopting new technologies, innovations, and equipment.

## Graphic Communications Undergraduate Programs

There are many graphic communications undergraduate programs offered in universities in the United States. Some of the graphic communications programs are general in nature, while others are combined with technology, computer, marketing, management, or journalism programs.

Graphic communications programs typically require technology-related courses, business and management courses, and additional math/science courses. Technology-related courses include electronic prepress, lithography technology, inks and substrates, binding and finishing, etc. Business and management courses include printing marketing and sales, principles of management, financial accounting, and fundamental economics. Math/science courses include calculus, algebra, trigonometry, statistics, and chemistry.

According to a review of undergraduate graphic communications programs offered in the United States, the most frequently offered courses are as follows: (a) Introduction to Graphic Communication, Technology or Industry; (b) Estimating, Pricing, or Costing; (c) Image Capture & Manipulation, Digital Image, or Image Conversion; (d) Lithography or Presswork; (e) Production Management or Printing Supervision; (f) Co-Op, Practicum, or Internship; (g) Postpress: Binding, Finishing, Mailing, or Distributing; (h) Paper or Ink Technology; (i) Electronic Publishing or Digital Publishing; (j) Color Electronic Prepress System; (k) Seminar or Senior Project; (l) Screen, Flexography, Gravure, or Special Printing; and (m) Layout Design, Illustration Design, Computer Graphics, or Image Layout.

Many graphic communications courses are not directly related to graphic communications technology. Courses such as technical writing, fundamental management and marketing, career planning, industrial safety, environmental technology, and communication skills also play an important role in the program. Because of this, graphic communications graduates understand the broader field of graphic

communications. The printing and publishing industry is not an isolated industry and has always needed a variety of people with different skills. Courses reflect this diversity.

A review of the graphic communications programs also shows that more programs focus on management than technology. It appears that gaining management knowledge, skill, and theory is a vital issue in graphic communications programs.

## Issues in Graphic Communications that Influence Program Content

### Graphic Communications Technologies

A variety of technologies are used in the printing industry. When technology is used properly, it increases production efficiency, helps printers meet customer needs, allows printers to stay in business, and enables new customer-focused service (Roth, 2000). However, technology does not necessarily give printers a long-term competitive edge, assure customer loyalty, develop new markets, impress customers, or make printers consistently profitable (Roth, 2000). For example, print buyers do not buy technology, but they buy what technology creates (Paparozzi, 2000). Printer buyers do not care what equipment or new technologies printers use; they only care that quality jobs can be done cheaply and on time. Even with these drawbacks, most printers take the business risk of using new technologies.

Printing has entered the Information Age and Digital Age ("Digital Roadmaps," 2000). New printing technologies have created several new market niches, such as variable data printing, and short-run and on-demand printing markets, which traditional printing technology could not make cost-effective and efficient with acceptable quality. Technological advances have greatly improved many operations in the printing industry

(Zwang, 1998). The primary advances will be reviewed in this chapter since these have relevance for this study.

Digital printing. Digital printing is the latest innovation in the printing and publishing industry, although it is not a completely new development. Romano (2000a, p. 2) defines digital printing as "any reproduction technology that receives electronic files and uses spots (or dots) for replication. This covers almost every present system for outputting graphic information to film, plate, or paper."

Three major categories of digital printing equipment were introduced at DRUPA 95: DI (Directing-Imaging), CTP (Computer-to-Plate), and the toner-based digital printing press. The move toward a digital technology has involved high capital investment costs ("Printing and Publishing," 2000). However, digital printing operations are now reaching commercial viability with reasonable prices that mid-sized and smaller printers can afford (Vision 21, 2000). There were 4,000 installations of CTP in 1999, 1,400 DI installations worldwide in 1999, and 23,900 on-demand printing units in 1999. In addition, 7% of all printers have digital printing (Ryan, 2000). Fortunately, the return on investment (ROI) of CTP is only approximately 35 months, and 83% of printers say they will buy another unit in the future (Ryan, 2000).

The rising demand for digital printing equipment is encouraging for the development of digital printing technologies. Efforts to increase digital press size, speed, resolution, and overall capacity are still in progress, and new features are being added to these presses, such as in-line finishing operations. The following features and factors are driving digital printing innovations: (a) short runs (above zero copy), (b) the just-in-time

approach, (c) distribution and printing, (d) an increase in response rates and sales using database or direct marketing, (e) faster turnaround, and (f) easy updatability (Fenton, 2000; Hilts, 1997; Romano, 1999c, 2000a).

Digital printing can be used for personalized printing and mailing, customized printing, variable printing, on-demand printing, and creating new printing markets. In the survey "Commercial Print 2010" conducted by TrendWatch (1999), 56% of printers believed that personalization and customization will be essential parts of their strategy by the year 2005 (Webb, 2000). In a discussion of personalized and customized printing, Romano (1999c, p. 4) states, "Making each sheet different lets you produce personalized or customized sheets that add information about me, to me, for me, concerning me – me, the most important in my life." It is certain that personalized printing offers a better return on investment because it is the key to success in short-run color printing (Sharples, 1998).

As customers' needs for customization and personalization increase, variable data printing will increase printers' profitability (Crim, 1998). Variable data has been defined as follows: "each printed piece can be different and that customized and personalized printing can be produced for target marketing purposes" (Romano, 2000a, p. 17). It has advanced from an experimental to a more mature technology (Schmidt, 2000). Broudy and Romano (1999) project that variable data application and on-demand print technology will propel the printing industry to about $35 billion in revenues by the year 2001. The Internet could drive additional revenue due to the increase in the demand for print-on-demand services (Webb, 1999a).

Furthermore, digital printing could easily change the "print-and-distribute" methodology to "distribute-and-print" to save delivery time and cost. Digital printing allows a publication to be sent remotely and printed locally by digital press (Harper, 2000). This can benefit printers, print buyers, and the general public.

Digital printing is cost effective for short-run and quick-turnaround jobs as long as the unit cost of digital printing stays low. There is a myth that selling more small-run jobs means that the profit will go up. On the contrary, profit will probably be lower because the printer is doing more jobs, such as order entry, re-estimation, preflight, correction, and prioritizing for faster turnaround, and has to set up more frequently, requiring greater maintenance, and perhaps resulting in more breakdowns, all of which will cause costs to rise (Fenton, 2000; Paparozzi, 2000).

Digital printing holds promise for minimizing pollution. The Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) are watching environmental and safety issues related to this technology (Fricke, 1999), but digital printing appears to meet the standard requirements for environmental regulations.

Digital proofing. Digital proofing is "a proof, either a color or black-and white reproduction, produced directly from digital data, without any intermediate production of film" (R. M. Romano & F. J. Romano, 1998, p. 238). It is a new technology that can increase the efficiency of the printing process. Schildgen, Benham, Lestar, and Jose (1998) state "Better quality color demands will drive the development of improved products that are more cost effective on a peer-proof basis," and digital proofing "will be

reinforced by the continued evolution of digital reproduction systems" (p. 168). Traditional analogue proofing is considered higher quality, but digital proofing has matured, and many options can be chosen to satisfy customers' individual requirements (Zwang, 1998). The new technology minimizes the difference between proofing methods and most people cannot tell the difference between products produced by a digital proofer or analogue proofer (Tolliver-Nigo, 1998).

When a digital proof is created that can be physically held, that is known as hard digital proofing. However, soft proofing is another form. Soft proofing involves viewing clients' jobs remotely with a monitor (Schildgen et al., 1998; Zwang, 1998). For one or two-color printing, there is often no need to have a hard proof. Furthermore, the use of soft proofing is becoming acceptable due to effective ICC color management as well as the increased use of PDF (Zwang, 1998).

Workflow and PDF. Workflow is all the stages through which a printing project or job must pass until it is completed (R. M. Romano & F. J. Romano, 1998). In today's digital printing environment, digital workflow has become the way to process printing jobs. A perfect and efficient workflow is considered important for succeeding in an all-digital environment.

In processing a printing job, many workflow models can be used. After analyzing the different steps most commonly encountered, printers might design one or more workflows which can handle those processing steps in an efficient way (Romano, 1999a). Furthermore, well-planned workflow will dramatically improve throughput, increase customer satisfaction, and reduce job cost (Schildgen et al., 1998).

One other key element in workflow is PDF. Portable Document Format is an Adobe file format using a page-description language with a smaller file size than most other competing technologies (Romano, 2000a). The PDF file format is becoming a standard for layout-driven documents intended to be moved electronically, as well as viewed or printed at a remote site, yet still retain their content and format integrity (Anderson, Eisley, Howard, Romano, & Witkowski, 1998; Cost, 1997; Romano, 1999a).

PDF can be in the forefront of moving workflow to a totally automated system (Anderson et al., 1998); and automation permits the combination of complex and simple tasks that do not need manual intervention and achieves lower costs and faster deliveries (Romano, 1999a). Most printers who have moved to digital workflows have realized that PDF has achieved success in a number of printing areas (Zwang, 1998). PDF as a type of workflow is a major advancement in graphic process automation because it can increase productivity tremendously ("The Outlook for PDF," 1997).

Marketing in Graphic Communications

After a decade of constant growth during the 1990s, the U.S. economy is in its longest economic expansion in recorded history. As projected for the coming decade, the economic situation will still be strong, but at a slower growth rate (Paparozzi, 2000). This strong and continuous U.S. economic growth will present the printing industry with many rising opportunities but in a highly competitive environment (Vision 21, 2000).

When comparing the real print sales estimates and the GDP (Gross Domestic Products) for 1998 to 2000, the GDP increased around 4.3%, while print sales increased by only around 2.0% (Paparozzi, 2000). Printers must pay more attention to this data

because it indicates a potential crisis for the printing industry. Fortunately, "The new investments by U.S. printers have increased their plant capacity, leading to more competitive pricing in markets for printed products and intensifying the industry's movement toward reductions of and consolidations among printing firms" ("Printing and Publishing," 2000, p. 25:3). Printers optimistically believe that the difference between the GDP and print sales growth is not a drop but suggests that the printing industry is in a stage of transition (Paparozzi, 2000).

There is a new market for the printing business, e-commerce, which is gaining wide popularity because the Internet provides opportunity and convenience for the printing business. Ryan (2000) states that more printers will and should offer printing e-services as a major strategy because 35% of total output will go to digital printing (on-demand) by 2006, and 15% of paper and printing purchased in 2003 will use e-commerce. Romano adds, "Right now, printing is a smokestack industry, but it must to enter the Internet age. Someone is going to get rich making that happen" ("Print Procurement," 2000). However, printers should notice that the Internet will reduce the number of jobs in graphic communications (Webb, 1999b).

Grant McGuire, the president of R.R. Donnelley & Sons, the world's largest printer, states that the Internet is a marketing tool for trade books that has just begun to be exploited (Hilts, 1997). He further states that electronic products, such as electronic books (CD-ROM or on-line) and World Wide Web, place a long-term threat to printed books (Hilts, 1997). Webb (2000) also states that the Internet is stealing product information, support, and transaction dollars from print, and not just from advertising

dollars. Therefore, those printers who decide not to be involved with Internet-related business will probably go out of business sooner or later (Leland, 1999) because it will affect the printing business over the next two years (Paparozzi, 2000). Still, many printers disagree that the Internet can find more customers (Webb, 1999b). Even Leland (1999) states that while he believes e-commerce will "become a big deal," he does not think "the future is here yet" (p. 56).

The Internet's effect on productivity and purchase/product information is revolutionary (Webb, 2000). Over the next few years, the Internet will become a much more ubiquitous business tool for printers to communicate and link with customers and suppliers. Printers will utilize the Internet to market, sell, and distribute print, manage print production, and order supplies (Vision 21, 2000). Furthermore, printers are simply waiting to go out of business if they are not participating in the Internet (Leland, 1999).

Electronic media, such as on-line newspapers and e-books, will influence marketing strategies because distribution time and cost put traditional print at a competitive disadvantage ("Printing and Publishing," 2000; Roth, 2000). Generally, customers are more judicious in their print purchasing habits. Therefore, it is better for printers to offer new services, such as electronic media, and stop selling "print," to become more of a communications company and truly be a full-service partner and total solutions provider as well as to help customers to achieve their goals (Paparozzi, 2000; Roth, 2000).

Management in Graphic Communications

Production scheduling and control, accounting, and finance are all necessary in managing a printing plant (Ruggles, 1991). Mondy and Premeaux (1995) define management as "the process of getting things done through the efforts of other people" (p. 6). Financial performance, marketing/sales plan, business planning, human resources, and quality control are all related to management performance (Campbell, 2001). James Tenorio, professor of graphic arts management at University of Wisconsin at Stout, states that they still teach the technical classes, but now "we focus more on the management side" (Ferris, 1994, p. 35). This illustrates the importance of printing management.

Human resources are one of the keys to the effective management of a printing business (Kibble, 1995). Payne (1988) states, "all types of resources are meaningless unless combined with the human factor because it takes people to run businesses and plants" (p. 12-1). Management has to stay attuned to employees because the rapid growth and change in technology requires them to update the knowledge and skills to operate the printing equipment (O'Brien, 1997; Payne, 1988).

Printing managers must also be good leaders (Ferris, 1994). Good managers in printing companies must have the quality of leadership so that they influence employees "to do what the leader wants them to do" (Mondy & Premeaux, 1995, p. 9). Further, Bart Kruponick, a management advisor to the printing industry, believes that "Today's managers must be good business people, forward thinkers and understand the business" (Ferris, 1994, p. 35).

Another major factor in printing management is production management since the printing industry is a manufacturing industry. Theodore Schultz, Nobel Prize winner in Economics, 1979, states that "Management must creatively deal with the varied and diverse new attitudes of today's workers in order to increase the contribution workers make to improving productivity (Payne, 1988, p. 12-1). Mondy and Premeaux (1995, p. 18-19) further state, "Productivity is a measurement of the relationship between inputs (labor, capital, natural resources, energy, and so forth) and the quality and quantity of outputs (goods and services)."

Achieving ISO and ANSI compliance is an important task in production management because it can reduce or eliminate errors and wasted time (O'Brien, 1997). Jimmy Doar points out "If we have written procedures and full training for each operation within our plant, which everyone understands and complies with, we can expect a consistent quality product" (O'Brien, 1997, p. 36).

Total Quality Management (TQM) is one of the important keys for printing growth (Esler, 1995; Ferris, 1994). Damien Gough, president of Laser Tech Color, also attributes the company's success to TQM ("Mission Possible," 1994). TQM can lead the customers, suppliers, printing companies, and printing company employees to work together as a team to fix and minimize the printing problems and to improve the product that is produced (Esler, 1995; "Mission Possible," 1994).

In production, production planning and scheduling is "the process that organizes the manufacturing routine of a printing business" (Sarkans, 1988, p. 24-2). Kibble (1995) points out that "The planning and scheduling of print jobs throughout a printing plant is

one of the most crucial business processes in the industry" (p. 114). These problems usually concern the core production of the company, and maintaining good production planning and scheduling can increase productivity and quality dramatically (Kibble, 1995).

Other Graphic Communications Trends

Since the current global economy has changed, printers must change traditional business practices, approaches, and cultures in order to survive and prosper in the new world (Marshall & Zoratti, 1999). Additionally, employee training and customer service, as well as increasing the value to customers, will be a good direction for printers to head (Margolis, 2000; Vision 21, 2000). On the other hand, it is interesting to note that print buyers do not care about the quality of printing products as much as printers do because print buyers realize that the general public does not care that much (Paparozzi, 2000; Webb, 1999a, 2000).

Paparozzi (2000) points out the following purchasing trends for printers: (a) CTP; (b) bindery and finishing equipment; (c) job-specific employee training/education; (d) lithographic presses with more than four colors; (e) digital proofing; (f) e-commerce capabilities; (g) mailing and fulfillment capabilities; (h) management information systems; (i) digital printing; and (j) internal or external networks.

Paparozzi (2000), Romano (1999b, 2000b), Ryan (2000), and Webb (2000) see graphic communications trends as follows:

1. The demand for digital printing and fulfillment is growing.
2. Digital proofing is maturing and will share the market for analog proofing.

3. Printing presses are automated and faster.

4. Digital printing is presenting lithography a challenge in the categories of personalized and on-demand printing. Digital presses are solutions for shorter runs and faster turnarounds.

5. More printing information for clients is available on the Web.

6. The use of color in printing products is increasing.

7. Printing capacity will increase through productivity.

8. Digital photography is growing in use.

9. Desktop scanning has improved in quality and efficiency.

10. E-commerce is entering the printing market.

11. Computer-to-plate is an evolving printing process.

12. Web presses are reducing make-ready time.

13. The number of printing plants is decreasing.

14. A tight labor market and a shortage of qualified employees exist.

15. Reprint cycles will be longer.

16. Consolidation of the printing industry of large printers merging with or acquiring medium- and small-size companies will continue.

## Curriculum Planning

### Curriculum

Education needs to ensure that it continues to evolve, and that it responds appropriately not only to changes in society but also to our increasing understanding of the educational process itself (Kelly, 1989). Ratcliff (1997) states that curriculum is

recognized as the foundation of an educational system. In higher education in the United States, undergraduate curriculum is based on the differential structure at the institution, college, department, and program levels, which calls for the examination of those differential effects on students' intellectual, personal, and social growth (Ratcliff, 1997).

Undergraduate curriculum tends to include universal courses, each designed with its own purpose and environment (Levine, 1978; Ratcliff, 1990; Veysey, 1965). A broader view of curriculum defines it as subjects and subject matter, experience, objectives, a plan, courses offered, or documents that should all center on learners (Skeel & Hagen, 1971). It is necessary for educators to determine what a curriculum should be as well as the desired form, purpose, design, and evaluation (Lindquist, 1978). Furthermore, Skeel and Hagen (1971) point out the necessary characteristics of a curriculum:

1. Curriculum focuses on learners; its emphasis is upon the pupil and only indirectly and secondly upon the subject.

2. Whatever is taught must be understood by the learner to be vitally related to the achievement of his/her purpose.

3. School curriculum should facilitate a more thorough integration of the life of the school with that of the home, community, nation, and world.

4. School curriculum should emphasize meanings that will function immediately in improving skills and developing understanding.

Today's curricula are being affected by technology, accelerating the need for basic technological literacy and creating new areas of professional and technical

specialization related to technology (Farmer, 1997). Technology expands information access and use, forcing members of the general public to change the way they use knowledge. Therefore, it is not surprising that the nature and structure of the educational system should be changing so extensively now that we are experiencing change through rapid technological advances (Kelly, 1989).

Tyler's Curriculum Planning Model

Many national curriculum projects use procedural steps (rational-linear) in curriculum planning (Marsh & Willis, 1995). These projects are often based on Ralph Winfred Tyler's model, outlined in Basic Principles of Curriculum and Instruction (1949). In a discussion of curriculum planning, Tyler (1975) sums up his thoughts as follow.

> Curriculum planning is a practical enterprise not a theoretical study. It endeavors to design a system to achieve an educational end and is not primarily attempting to explain an existential phenomenon. The system must be designed to operate effectively in a society where a number of constraints are present and with human beings who all have purposes, preferences, and dynamic mechanisms in operation. (p. 126)

Tyler (1949) suggested that the curriculum should consist of three elements of planning: (a) objectives (purposes), (b) content and the methods or procedures, and (c) evaluation. Tyler (1949) further states, "It should also be clear that these elements are not to be viewed as single, each to be a separate goal of instruction" (p. 94).

Tyler (1949) suggested curriculum planners should think about and answer four fundamental questions about their objectives/purposes before developing any curriculum.

> a. What educational purposes should the school seek to attain?
> b. What educational experiences can be provided that are likely to attain these purposes?
> c. How can these educational experiences be effectively organized?
> d. How can we determine whether these purposes are being attained? (p. 1)

Tyler (1949) states, "No single source of information is adequate to provide a basis for wise and comprehensive decisions about the objectives of the school" (p. 5). Tyler (1949) also states that every source has its values to commend it and should be given thorough consideration in planning any comprehensive curriculum program. This implies that curriculum planners should identify the general objectives by gathering data from the subject matter, the learners, and the society, then pass these through the screens of the philosophy of the school and the psychology of learning.

## Identifying Relevant Program Content

### Program Content

Program content is a major component in developing curriculum (Ediger, 1995). Curriculum planners must understand the nature and structure of content thoroughly in order to provide students appropriate and meaningful learning activities (Griffin, Dodds, & Rovegno, 1996).

Educators in curriculum planning are charged with selecting and organizing content in ways that generate and broaden students' interests, social context, or both (Hunkins, 1980). Saylor, Alexander, and Lewis (1981) state a meaningful definition of content.

> Content is those facts, observations, data, perceptions, discernments, sensibilities, designs, and solutions drawn from what the minds of men have comprehended from experience and those constructs of the mind that organize and rearrange these products of experience onto role, ideas, concepts, generalizations, principles, plans, and solutions. (p. 160)

William Chandler Bagley believes that the school curriculum should be relatively stable, and "a continuously changing curriculum should not be in evidence once essential

content has been identified and taught" (Ediger, 1995, p. 269). Content should be relevant to current times and the future; it should last over an extended period of time because content "contributes to the development of particular learning abilities, skills, processes, and attitude formation" (Hunkins, 1980, p. 221).

Identifying Program Content

Identifying program content is important in curriculum development (Morse & Corcoran-Perry, 1996). Ferren (1997) states that "Faculty believe they know best what students should learn and how they should learn it" (p. 536). Educators have the expertise to decide what content should be included in programs because curriculum has traditionally relied on what they want to offer and is useful for students to acquire information and skills they need (Ferren, 1997; Johnson, 1981; Kendall & Marzano, 2000).

Educators play an important role in the process of determining appropriate content since they are continuously identifying diverse materials for the program (Johnson, 1981). Educators can identify the values of program content to provide "more coherent educational experience for students" (Ferren, 1997, p. 534).

Methods for identifying content for this study. Voelker (1973) states that there are three typical methods of identifying curriculum content. They are: (a) analyzing existing materials, (b) formulating a questionnaire and sending it to professionals, and (c) combining both previous techniques.

By using the combination approach of Voelker's (1973) method to identify the content, the general content in the graphic communications program can be gathered and

analyzed to generate a questionnaire. The importance of content items in the questionnaire can be evaluated and judged by the experts (educators). Furthermore, by analyzing those responses, relevant program content in the graphic communications program can be identified.

The current curriculum in the graphic communications programs is one of the major sources of existing materials to identify and analyze program content. The textbooks and reference books can also be examined for content identification (Siegel, 1954). Other existing materials include information from presentations at seminars or conferences, reports from printing organizations, and articles in professional magazines and journals. The resulting materials can be assembled for use in identifying the graphic communications program content (Olson, 1958).

## Survey

Surveys are often used in descriptive research, and can be used to examine many sensitive topics that are of interest to educators (J. P. Gall, M. D. Gall, & Borg, 1999). Survey research is generally an easy, quick, inexpensive, and accurate way to get required information (Alreck & Settle, 1995).

Fowler (1993, p. 1) states three major characteristics of surveys:

1. The purpose of the survey is to produce statistics – that is, quantitative or numerical descriptions of some aspects of the study population.
2. The main way of collecting information is by asking people questions; their answers constitute the data to be analyzed.
3. Generally, information is collected from about only a fraction of the population – that is, a sample – rather than from every member of the population.

Questionnaire

Questionnaires are a good method for obtaining data for a needs assessment (Pratt, 1980). Questionnaires permit anonymity and are answered in the respondent's own time, which produces more accurate self-reported data if confidentiality can be ensured (Pratt, 1980; J. P. Gall, M. D. Gall, & Borg, 1999). Questionnaires have some advantages -- standardized wording, a lack of interview bias, respondent privacy, cost and time saving, securing information, great assurance of anonymity, and convenience (Babbie, 1990; Bailey, 1987; Balian, 1982; Balsley & Clover, 1988). On the other hand, questionnaires also have some disadvantages – a low response rate, possibility of biased sample, lack of flexibility, and less cooperation from respondents (Bailey, 1987; Balian, 1982; Balsley & Clover, 1988; Lang & Heiss, 1984).

Research objectives are defined first when designing an instrument. After defining the objectives, the sample and population are identified and the items in the questionnaire are developed and constructed (Bailey, 1987; Balian, 1982; Callahan, 1996; M. D. Gall, Borg, & J. P. Gall, 1996). Items should be clear, short, simple, precise, unambiguous, easy to understand, and necessary as well as relevant in answering the research questions (Ary, Jacobs, & Razavieh, 1990; Babbie, 1990; Balian, 1982; Cohen & Manion, 1985; Crowl, 1986; Sudman & Bradburn, 1982).

When a response scale for items in the questionnaire is used, a five-point type of Likert-scale is appropriate for "relatively simple questions with average spread expected" (Balian, 1982, p. 88). This scale is often "used to register the extent of agreement or disagreement with a particular statement of an attitude, belief, or judgment" (Tuckman,

1988, p. 192). This type of Likert-scale generally has odd numbers of options for answering the questions.

In addition, the scale designed for a questionnaire is important because it can affect the response rate. Simple, easy, and clear statements plus appropriate scale design can increase the response rate. However, there is no statistical basis for determining a response rate when conducting a questionnaire (Babbie, 1990). Normally, researchers can expect a 30% return from a population (Behling, 1976).

A mailed questionnaire is one of the most common methods of data collection in educational research (M. D. Gall, Borg, & J. P. Gall, 1996). Furthermore, a stamped and self-addressed envelope attached with the questionnaire is definitely helpful in increasing response rate, along with a follow-up mailing (Bailey, 1987; Balian, 1982; Wiersma, 1991). However, unless the response rate is low or the researcher requires a high response, repeated follow-ups are not a common way to collect data (Wiersma, 1991).

## Factor Analysis

Factor analysis has been applied to many research projects starting in the beginning of the 20th century. In "General Intelligence, Objectively Determined and Measured," published in 1904, Charles Spearman discussed his "well-known Two-Factor Theory" (Harman, 1976, p. 3); and Karl Pearson was the first to delineate an explicit procedure for factor analysis (Child, 1970). In the next 20 years, elaborate and refined psychological and mathematical arguments flourished and were explored by Charles Spearman, Cyril Burt, Karl Pearson, Godfrey Thomson, Maxwell Garnett, and Karl Holzinger (Child, 1970; Harman, 1976). Charles Spearman is regarded as the father of

factor analysis, since he devoted 40 years of his life to developing factor analysis (Harman, 1976).

In the almost one hundred years in the development of factor analysis, many scholars have stated the meaning and definition of factor analysis as follows.

1. "Factor analysis is a branch of multivariate analysis that is concerned with the internal relationships of a set of variables" (Lawley & Maxwell, 1971, p. 1).

2. "Factor analysis consists of a collection of procedures for analyzing the relations among a set of random variables observed, counted, or measured for each individual of a group" (Cureton & D'Agostino, 1983, p. 1).

3. Factor analysis is a measure of the degree of generalizability found among variables (Gorsuch, 1974). It is a general scientific method for analyzing data (Rummel, 1970).

Cureton and D'Agostino (1983, p.2) state that the purpose of a factor analysis is: "to account for the interrelations among ***n*** variables, by postulating a set of common factors, considerably fewer in number than number, ***n***, of these variables." Factor analysis may also be used as an expedient way of ascertaining the minimum number of hypothetical factors that can account for the observed variables, and as a means of exploring the variable(s) for possible data reduction (Kim & Mueller, 1978a). In a more detailed description of using factor analysis, Grosuch (1974, p. 3-4) makes a clear statement about the purposes for which factor analysis can be used.

> 1. Through factor-analytic techniques, the number of variables for further research can be minimized while also maximizing the amount of information in the analysis. The original set of variables is reduced to a much smaller set which accounts for most of the reliable variance of the initial variable pool. The smaller

set of variables can be used as operational representatives of the constructs underlying the complete set of variables.
2. Factor analysis can be used to search data for possible qualitative and quantitative distinctions, and is particularly useful when the sheer amount of available data exceeds comprehensibility. Out of this exploratory work can arise new constructs and hypotheses for future theory and research. The contribution of exploratory research to science is, of course, completely dependent upon adequately pursuing the results in future research studies so as to confirm or reject the hypotheses developed.
3. If a domain of data can be hypothesized to have certain qualitative and quantitative distinctions, then this hypothesis can be tested by factor analysis. If the hypotheses are tenable, the various factors will represent the theoretically derived qualitative distinctions. If one variable is hypothesized to be more related to one factor than another, this quantitative distinction can also be checked.

Researchers usually employ five major steps in obtaining a solution to exploratory factor analysis: (a) selecting the variables, (b) computing the matrix of correlations among variables, (c) extracting the initial (un-rotated) factors, (d) rotating the factors, and (e) interpreting the rotated factor matrix (Comrey, 1973; Kim & Mueller, 1978b). Although these steps might not always be followed in obtaining the final solution, it is still convenient to discuss the factor analysis with reference to these steps (Kim & Mueller, 1978a).

## Summary

As part of the literature review, new technologies and innovations impacting the printing industry were presented since this is important for study of graphic communications content. Management and marketing related to the printing industry was also presented.

The role of content in curriculum planning was discussed in this chapter. Content plays an important role in the curriculum planning according to Tyler (1949). Further,

Voelker (1973) states that a combination of literature review and survey is a good technique for identifying content.

In the last part of the literature review, research techniques used in this study were presented. The survey questionnaire is a widely used method to collect required information in descriptive research because it is an easy, convenient, quick, accurate, and inexpensive way to generate opinions. After content has been identified via the survey, statistical methods, such as factor analysis provides a way to identify patterns in responses.

# CHAPTER III

# METHODOLODGY

This is a descriptive research study to determine the appropriate content for a comprehensive undergraduate graphic communications program by soliciting the opinions of educators in four-year colleges or universities. The methodology of this study includes the use of an Expert Panel to develop a questionnaire, surveying faculty, and analyzing the data with statistical methods.

## Expert Panel and Population Characteristics

Two groups were used in this study: an Expert Panel made up of chairpersons or coordinators in graphic communications programs, and graphic communications faculty who are actively teaching graphic communications courses in four-year colleges or universities. The population and sample will be discussed as follow.

### The Expert Panel

The Expert Panel consisted of educators from the population of all the educators who teach graphic communications courses in four-year colleges or universities and who maintain an active TAGA Student Chapter. TAGA is actively associated with the printing industry and graphic communications departments in universities worldwide; the members in the Student Chapters of TAGA are also strongly engaged with the printing community. With assistance from Kara Knopf, Assistant to the Director of TAGA, the Expert Panel in this study was chosen based on having an active TAGA chapter and being in charge of curriculum design for a graphic communications program as chairperson, coordinator, or curriculum developer. They were perceived to be familiar

with the skills and knowledge required for students to achieve success and intimately aware of the changes in the graphic communications industry as well as the needs of print buyers.

Graphic Communications Faculty

The population for the final stage of the questionnaire consisted of instructors, assistant professors, associate professors, and professors who were actively teaching undergraduate graphic communications courses in the United States. A list of graphic communications programs was acquired from Careers in Graphic Communications: A Resource Book, and further delimited to departments offering complete graphic communications programs in four-year colleges or universities, such as the B.A. or B.S. degree (Flecker & Groff, 1998). A list of faculty members was generated through institutional websites during fall 2000.

Based on the information obtained from department websites, 156 qualified educators were selected as the population. The number is relatively small, so a sampling technique was not used in this study. Finally, the survey questionnaires were sent to all qualified graphic communications faculty in the population.

## Research Instrument

Expert Panel Input for Questionnaires

Content items and subject categories on the Expert Questionnaire were obtained by reviewing current graphic communications curricula, graphic communications textbooks, studies and dissertations on curriculum, and various public and private businesses and organizations with publications related to graphic communications. The

Expert Questionnaire (see Appendix B) was generated after being reviewed for grammar and spelling by Dr. Charles Johnson, professor and coordinator of the Graphic Communications Program in the Department of Industrial Technology at the University of Northern Iowa. A cover letter (see Appendix C) was also developed, which included information about the purpose of the study and how panelists were selected.

A type of Likert-scale was used for panelists to rate the importance of graphic communications program content, with ratings of 1 = No Importance: 2 = Low Importance; 3 = Moderate Importance; 4 = Fairly High Importance; and 5 = Very High Importance. The panelists were asked to judge the importance of the content items and encouraged to add or change content items or subject categories at the end of the questionnaire.

A second round of the questionnaire was sent to the Expert Panel to ensure the validity of the revised content items and subject categories. Several new content items and one new subject category were added as a result of the panelists' input during the first round of the questionnaire.

Pilot Test

After input by the Expert Panel, the questionnaire (draft) was developed and a pilot test was conducted. Two educators, one the coordinator of a graphic communications program and the other a part-time instructor who works for industry, were asked to participate in the pilot test. The suggestions from these two educators were valuable in modifying the questionnaire to increase its validity and reliability for the graphic communications faculty who would participate in this study.

Survey Questionnaire

After the pilot test was finished, the final questionnaire of 68 content items in 15 subject categories was generated. The survey questionnaire consisted of two sections: demographic questions and the program content. A cover letter (see Appendix D) was also developed. This cover letter included information on the purpose of the study and the confidentiality of responses. A revised type of Likert-scale was used for responding to content items, with the five alternative ratings being: 1 = No Importance; 2 = Low Importance; 3 = Moderate Importance; 4 = Fairly High Importance; and 5 = Very High Importance.

## Data Collection Procedure

Three phases of data collection were used in this study based on suggestions from Mail and Telephone Surveys (Dillman, 1978). They included surveying an Expert Panel, a pilot study, and a final questionnaire.

Two rounds of Expert Questionnaires were conducted. The cover letter and the questionnaire were sent out via e-mail and U.S. postal service to the five Expert panelists. All the panelists were assigned a number for convenience in conducting the Expert Questionnaire. One week after the e-mails and letters were sent out, follow-up phone calls were made to those who did not respond. The same procedure was used in conducting the second questionnaire, but only e-mail was used.

After a draft questionnaire was developed based on comments from the Expert Panel, it was sent to two educators to evaluate and examine. To ensure full participation, the draft questionnaire pilot test was sent via e-mail and traditional mail.

With the final version of the questionnaire, 156 educators were sent a questionnaire containing an assigned number. A cover letter and a stamped, self-addressed return envelope accompanied each questionnaire. In addition, e-mail addresses were obtained for 140 of the 156 educators and these individuals were sent an e-mail message with two options for responding. These included a questionnaire in the form of an e-mail attachment and a hyperlink to a personal website containing a questionnaire that could be completed on-line. These procedures were used to increase the educators' willingness to participate in this study, to make it convenient for them to do so, and to eliminate the need for follow-up mailings.

One reminder was mailed to the 60 educators who did not respond. After collecting 99 responses from the participants, the data was tabulated.

## Data Analysis

After the questionnaires were returned, data analysis began. The Statistical Package for Social Sciences (SPSS) was used to perform data analysis. The study used a type of Likert-scale with five alternatives of importance, so the interval and ratio data generated were treated as continuous data (Balian, 1982).

The stem-and-leaf display is a way to organize interval-scaled data. It was used to display the demographic related to the years of teaching experience for all graphic communications faculty, instructors, assistant professors, associate professors, and professors.

There were 68 content items in 15 subject categories in the questionnaire. Cronbach's Coefficient *Alpha* ($\alpha$) can be used to determine the reliability of standard

scales when items are scored polychotomously (Borg & Gall, 1989; Cronbach, 1951). It is the most common method of estimating test score reliability of individual items in an instrument (M. D. Gall, Borg, & J. P. Gall, 1996; McMillan, 2000). This reliability index was used to measure the internal consistency of content items within subject categories.

As stated earlier, this study contains 14 subject categories (excluding the subject category *Others*), which covers very broad subject areas in graphic communications. Using factor analysis, subject categories will be group together with similar characteristics to reduce the number of subject categories. Gorsuch (1974, p. 3) states, "The aim of factor analysis is to summarize the interrelationships among the variables in a concise but accurate manner as an aid in conceptualization." This means that the factor analysis technique can (a) minimize the variables and (b) detect and clarify structure in the relationships between variables ("Principal Component," 2001). Therefore, for finding meaningful patterns among all the subject categories, the factor analysis method was an appropriate method to use for the purpose of this study.

Additionally, correlation matrices were necessary to interpret the reliability and factor analysis data for answering the research questions. The correlation matrices of those content items within each subject category and the correlation matrix between the subject categories were generated and presented based on the collected data which made the statistical analysis possible.

## Summary

An Expert Panel, consisting of five carefully chosen educators, was used to identify important graphic communications content. A questionnaire was developed for

graphic communications educators using this content. This was pilot tested with two educators to increase the reliability. The survey questionnaire was then sent to graphic communications faculty to obtain ratings on importance of content items and subject categories.

SPSS was used to perform the data analysis. Two statistical methods were used for this study. These included Cronbach's Coefficient *Alpha* for determining reliability (internal consistency) among content items within each subject category and factor analysis to analyze subject categories for possible combination.

# CHAPTER IV

# FINDINGS

The findings are based on an analysis of the questionnaire responses. This chapter consists of two sections. The first section describes the demographic characteristics of the participating graphic communications faculty and Expert panelists. The second section presents the findings based on the research questions as well as discussion.

## Questionnaire Responses

A total of 156 survey questionnaires were sent out to graphic communications faculty in the population. A total of 99 questionnaires were returned, a response rate of approximately 63.5%.

For convenience, graphic communications faculty were given three options for responding to this study: (a) hardcopy letter, (b) e-mail with attachment, and (c) on-line survey. A hardcopy letter was sent to every graphic communications faculty member in the population. A total of 140 of the participants were also sent e-mails with an attachment (MS Word document) and an on-line questionnaire linked to their personal web pages (the e-mail addresses could be traced from their college's websites). Of the 99 respondents, 62 educators participated in hardcopy letter (62.6% of participants or 39.7% of population), 12 in e-mail with attachment (12.1% of participants or 7.7% of population), and 25 through the on-line survey (25.3% of participants or 16.0% of population).

Demographic Characteristics

Seven of the 99 responding participants did not answer the demographic questions, leaving a total of 92 participants who provided demographic information. The demographic characteristics of the participants are presented in Table 1.

Table 1

Demographic Characteristics of Graphic Communications Faculty

| Title | Frequency | Male | Female |
|---|---|---|---|
| Instructor | 20 | 14 | 6 |
| Assistant Professor | 21 | 14 | 7 |
| Associate Professor | 21 | 19 | 2 |
| Professor | 30 | 28 | 2 |
| Total | 92 | 75 | 17 |

Note. Seven (7) participants did not provide this information.

Stem-and-leaf display is "a generalized two-digit display, in which the left-hand portion of the values displayed is given by a stem value, while the right-hand portion makes up a leaf" (Tukey, 1977, p. 675). This display can be used to construct frequency distributions and histograms (Keller & Warrack, 2000). This technique is used to show years of teaching experience and the academic title for graphic communications faculty in Appendix E.

The mean score of years of teaching experience for all participants is 17.3 years and the median 16.0 years. The histogram of years of teaching experience for graphic communications faculty is slightly skewed to the right (see Figure 1). However, based on visual inspection, the histogram appears to be close to a normal curve. The mean scores

for years of teaching experience for graphic communications faculty are (a) instructors: 11.9 years, (b) assistant professors: 11.1 years, (c) associate professors: 18.5 years, and (d) professors: 24.4 years.

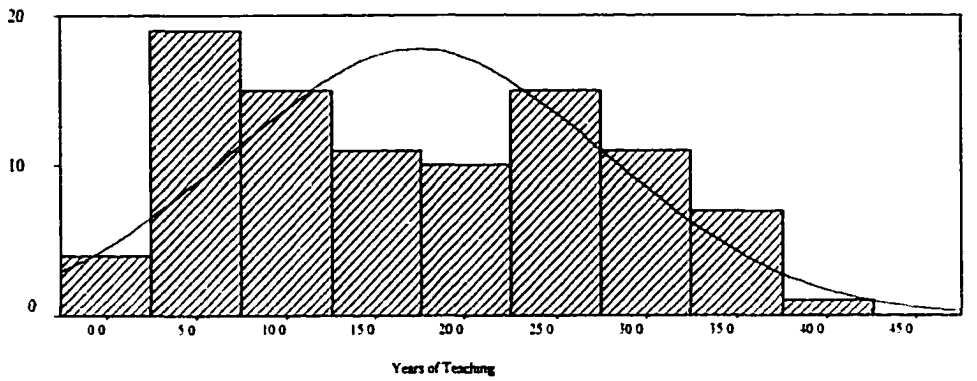



Figure 1. Histogram of Years of Teaching Experience for Graphic Communications Faculty.

## Findings for Research Questions

### Research Question One

Research question one concerned identification of important content for undergraduate graphic communications programs as determined by a review of the literature and an Expert Panel. Based on the literature review, content items and subject categories were identified. These items were then rated by the Expert Panel. Based on ratings and recommendations changes were then made, and the revised list of items was sent to the Expert Panel a second time for ratings and further revision. After these two rounds, 68 content items in 15 subject categories were identified. These are shown in the Appendix F. The abbreviation for each content item and subject category are shown in Appendix G.

After the first round of content identification by the experts, the following changes were made: content item *Design for World Wide Web* was added into the *Graphic Design* subject category; content item *Distribution/Demographic Finishing* was added in the *Postpress* subject category; content item *Electrophotographic/Non-Impact* was added in the *Press* subject category; content item *Film and Digital Imaging and Editing* was expanded to *Imaging Acquisition and Editing*; and *Film Imaging Technology* was added to the *Prepress* subject category.

Another change after the first round was the addition of a new subject category, which was *Digital Media/Publishing*. Four content items were placed in this subject category, including *Streaming Video*, *E-Book*, *Cross Media Publishing*, and *Digital and Web Publishing*. This last content item was moved from the subject category *Digital Printing Technology*.

After two rounds of feedback by the Expert Panel, 68 content items in 15 subject categories were identified, and all were rated by the experts as being above moderately importance ($\underline{M} = 3.0$) except four content items, General Physics ($\underline{M} = 2.8$), Finite Mathematics ($\underline{M} = 2.6$), Programming Language ($\underline{M} = 2.6$), and Calculus ($\underline{M} = 2.4$). Ratings by the experts are shown in Appendix H.

Research Question Two

Research question two was concerned with the ratings of content items by graphic communications faculty. In order to answer this question, a survey questionnaire was developed which contained the content items identified by the Expert Panel.

The mean scores and standard deviations for each content item in each subject category as rated by graphic communications faculty are reported in Appendix I. The mean scores for every subject category are determined by computing a grand mean for all the content items within the subject category. These are shown in Appendix J.

Graphic communications faculty rated the content items in all 15 subject categories using a five-point scale, this being 1 = No Importance; 2 = Low Importance; 3 = Moderate Importance; 4 = Fairly High Importance; and 5 = Very High Importance. The means for subject categories ranged from moderate importance ($\underline{M}$ = 3.31) to fairly high importance ($\underline{M}$ = 4.53).

Table 2 shows the mean scores in descending order for all subject categories. Ten subject categories had a mean rating of 4.0 (fairly high importance) or above. Five of the subject categories were rated between 3.31 and 3.96, with 3.0 being moderate importance. These ratings support the experts' perceptions of these subject categories.

Regarding the 68 content items within the 15 subject categories, the range of mean scores was from 4.75 to 2.56. Forty-one of the content items received a mean score of 4.0 (fairly high importance) or above. Twenty-four of the content items received a mean score between 3.0 (moderate importance) and 4.0. Only three content items received a mean score below 3.0. These content items received mean ratings of 2.56 to 3.0.

Generally, the importance of the content items reflected the same importance level as the corresponding subject category. Content items that received a mean rating above 4.5 (between fairly high importance and very high importance) are shown in Table

3. Those content items that received a mean rating below 3.0 included *Calculus* (M = 2.56), *Programming Language* (M = 2.72), and *Finite Mathematics* (M = 2.82).

Table 2

Mean Scores of Subject Categories from Highest to Lowest Importance for Graphic Communications Faculty

| Subject Category | M | N |
|---|---|---|
| Prepress (PRE) | 4.53 | 94 |
| Basic Communication Techniques (CTE) | 4.41 | 99 |
| Digital Printing Technology (DPT) | 4.37 | 99 |
| Safety and Health (SAH) | 4.33 | 98 |
| Production Management (PMT) | 4.26 | 98 |
| Graphic Design (GDN) | 4.21 | 98 |
| Graphic Communications Past and Future (PAF) | 4.20 | 98 |
| Press (PSS) | 4.19 | 98 |
| Others (OTH) | 4.15 | 99 |
| Fundamental Marketing (FMT) | 4.00 | 98 |
| Business and Management (BAM) | 3.96 | 97 |
| Postpress (POS) | 3.95 | 99 |
| Digital Media/Publishing (DMP) | 3.65 | 97 |
| Computer (COP) | 3.64 | 98 |
| Science and Mathematics (SAM) | 3.31 | 98 |

Note. Subject categories correspond to the questionnaire.

Based on the ratings for subject categories and content items by faculty, all except three of the items are considered to be of moderate importance to fairly high importance. The three items that received a mean rating below 3.0 were still above 2.5, and the subject categories that contained these content items received a mean score of 3.31 or above. This was further analyzed later using reliability and factor analysis statistics.

Table 3

Mean Scores of Content Items above 4.5 as Rated by Graphic Communications Faculty

| Content Item | M | N |
|---|---|---|
| Interpersonal Communications Skills | 4.75 | 99 |
| Color Reproduction & Separation | 4.68 | 99 |
| Oral Communications & Speech | 4.68 | 99 |
| Lithography Process | 4.65 | 98 |
| Electronic Prepress (Publishing) System & Desktop Publishing System | 4.68 | 99 |
| Current Developments & Trends in Graphic Communications | 4.64 | 98 |
| Composition/Imposition | 4.58 | 98 |
| Principles of Page Layout & Design | 4.57 | 99 |
| Digital Proofing | 4.55 | 99 |
| Preflighting | 4.54 | 98 |
| Color Management System | 4.54 | 99 |
| Imaging Acquisition & Editing | 4.53 | 99 |

Research Question Three

Research question three concerned an analysis of internal consistency of content items within each subject category. In other words, content items were analyzed to determine correlation between these items and to determine if they were appropriate for the subject category. The subject category *Other* was excluded because of the diversity of content, and was used for the last two research questions. Therefore, only 14 subject categories were analyzed.

Initially, correlation coefficients were generated to analyze the relationships between the content items within each subject category (see Appendix K). These coefficients were then used to generate Cronbach's Coefficient *Alpha*, a numerical coefficient of reliability. This was then used to test the internal consistency (reliability) of the content items within each subject category.

The Coefficient *Alpha* was generated for every subject category and is shown in Table 4. A number of researchers have suggested that .70 is an acceptable/satisfactory reliability coefficient, but a lower (.65) threshold is sometimes used in the literature (Cortina, 1993; McMillan & Schumacher, 1997; Nunnaly, 1978; "Reliability," 2001; "Reliability and item," 2001). If the *Alpha* shows poor reliability, the individual items within that scale might be re-examined and modified or completely changed/deleted as needed (Santos, 1999).

From Table 4, the Coefficient *Alpha* for subject category *Graphic Communications Past and Future* (PAF) is .61 (less than .70). Only two items are in this subject category which are *History of Graphic Communications* and *Current Developments and Trends in Graphic Communications*. The *Alpha* Coefficient indicates that the set of content items in this subject category may be low on homogeneity. Upon further examination, it is observed that these content items are not homogeneous which explains the *Alpha* Coefficient. However, these content items appear to be appropriate for this subject category.

Further analysis was done for each subject category in order to determine the role that every content item played within each subject category, regardless of whether the *Alpha* Coefficient was above .70 for the subject category. This was done by deleting each content item in turn, and then computing the *Alpha* (Table 5 to Table 16). If a particular content item is deleted and the Coefficient *Alpha* is increased, then that content item should be re-examined because it might not be tapping the same construct as all of the other content items ("Reliability," 2001). Subject categories PAF and SAH were

excluded from this process because only two content items existed in each of these subject categories and *Alpha* cannot be computed for a single item.

Table 4

Coefficient *Alpha* of Each Subject Category

| Subject Category | *Alpha* | N |
|---|---|---|
| Science and Mathematics (SAM) | .80 | 98 |
| Basic Communication Techniques (CTE) | .71 | 99 |
| Graphic Design (GDN) | .83 | 98 |
| Prepress (PRE) | .88 | 94 |
| Press (PSS) | .82 | 98 |
| Digital Printing Technology (DPT) | .87 | 99 |
| Postpress (POS) | .83 | 99 |
| Graphic Communications Past and Future (PAF) | .61 | 98 |
| Safety and Health (SAH) | .90 | 98 |
| Fundamental Marketing (FMT) | .88 | 98 |
| Business and Management (BAM) | .89 | 97 |
| Production Management (PMT) | .86 | 98 |
| Digital Media/Publishing (DMP) | .86 | 97 |
| Computer (COP) | .77 | 98 |

Note. Subject categories correspond to the questionnaire.

Table 5, the new Coefficient *Alpha* in the subject category *Science and Mathematics* (SAM) decreased for each content item deleted. This meant that these content items exhibit good internal consistency and that all the content items fit in this subject category.

In Table 6, when the content item *Business and News Writing* (BNW) is deleted from subject category *Basic Communication Techniques* (CTE), the internal consistency goes up. However, the new *Alpha* (.71) is the same as the original subject category *Alpha*, so it still appears to fit within this subject category.

Table 5

Coefficient *Alpha* if Content Items Are Deleted in Subject Category A: SAM (Initial *Alpha* = .80)

| If Content Item Deleted | *Alpha* |
|---|---|
| General Chemistry (CHM) | .75 |
| General Physics (PHY) | .74 |
| College Mathematics: Algebra/Trigonometry (ALG) | .77 |
| Finite Mathematics (FMA) | .78 |
| Calculus (CAL) | .77 |
| General Statistics (STA) | .78 |
| General Statistics (STA) | .78 |

Note. N = 94 to 99.

Table 6

Coefficient *Alpha* if Content Items Are Deleted in Subject Category B: CTE (Initial *Alpha* = .71)

| If Content Item Deleted | *Alpha* |
|---|---|
| Technical Writing (TWG) | .57 |
| Oral Communications & Speech (OCS) | .47 |
| Interpersonal Communications Skills (ICS) | .57 |
| Business & News Writing (BNW) | .71 |

Note. N = 99.

Table 7 shows that all the content items within subject category *Graphic Design* (GDN) are internally consistent because the content *Alpha's* are less than the original subject category *Alpha*.

In Table 8, when the content item *Film Imaging Technology* (FIM) is deleted from the subject category *Prepress* (PRE), the new *Alpha* (.91) is higher than the original subject category *Alpha* (.88). This indicates that this content item is less related to the subject category and may need further analysis. It is noted that the other content items in

this subject category relate to using the electronic or digital processes, but the content item FIM is a traditional (manual) process. Regardless, FIM will stay within the subject category based on the computed *Alpha*.

Table 7

Coefficient *Alpha* if Content Items Are Deleted in Subject Category C: GDN (Initial *Alpha* = .83)

| If Content Item Deleted | *Alpha* |
|---|---|
| Principles of Page Layout & Design (LDN) | .81 |
| Illustration & Computer Graphics (ILL) | .76 |
| Presentation & Animation Software (MUM) | .79 |
| Design for the WWW (DWW) | .79 |

Note. N = 99.

Table 8

Coefficient *Alpha* if Content Items Are Deleted in Subject Category D: PRE (Initial *Alpha* = .88)

| If Content Item Deleted | *Alpha* |
|---|---|
| Preflighting (PFT) | .87 |
| Imaging Acquisition & Editing (IAE) | .86 |
| Color Reproduction & Separation (CRS) | .85 |
| Composition/Imposition (COM) | .85 |
| Film Imaging Technology (FIM) | .91 |
| Electronic Prepress (Publishing) System & Desktop Publishing System (EPS) | .85 |
| Color Management System (CMS) | .87 |

Note. N = 98 to 99.

In Table 9, when the content item *Lithography Process* (LIT) or *Electrophotographic/Non-Impact* (EPE) is deleted from the subject category *Press* (PSS), the new *Alpha* (.81) is approximately equal to the original subject category *Alpha*. Even

though the removal of each of these items slightly improves the internal consistency, the *Alpha* is high enough to warrant keeping both these items in this subject category.

Table 9

Coefficient *Alpha* if Content Items Are Deleted in Subject Category E: PSS (Initial *Alpha* = .81)

| If Content Item Deleted | *Alpha* |
|---|---|
| Lithography Process (LIT) | .81 |
| Gravure Process (GRA) | .74 |
| Flexography Process (FLX) | .73 |
| Screen Process (SCR) | .75 |
| Electro-photographic/Non-Impact (EPE) | .81 |

Note. N = 98 to 99.

Table 10 shows that all of the content items fit appropriately in the subject category *Digital Printing Technology* (DPT), since all of the new *Alphas* (if each content item is deleted) are lower than the original subject category *Alpha*.

Table 10

Coefficient *Alpha* if Content Items Are Deleted in Subject Category F: DPT (Initial *Alpha* = .87)

| If Content Item Deleted | *Alpha* |
|---|---|
| Variable Data & Personalized Printing (VDP) | .83 |
| On-Demand Printing (ODP) | .80 |
| Computer-to-Plate & Direct-Imaging Technology (CTP) | .84 |
| Digital Proofing (PRF) | .85 |

Note. N = 98 to 99.

In Table 11, if the content item *Binding/Finishing Process* (BIN) is deleted, the *Alpha* is higher than the original subject category *Alpha.* It is believed that BIN belongs to the subject category *Postpress* (POS), so the increased *Alpha* might be caused by a random error. The content item BIN will remain in this subject category since the internal consistency is above .70.

Table 11

Coefficient *Alpha* if Content Items Are Deleted in Subject Category G: POS (Initial *Alpha* = .83)

| If Content Item Deleted | *Alpha* |
|---|---|
| Binding/Finishing Process (BIN) | .86 |
| Packaging Process (PAK) | .78 |
| Fulfillment (FUL) | .72 |
| Distribution/Demographic Finishing (DDF) | .77 |

Note. N = 98 to 99.

All of the content items in Table 12 appear to be suitable for the subject category *Fundamental Marketing* (FMT), since the new *Alpha* decreases when each content item is deleted.

The new *Alpha* for the content item *Business Law* (LAW) in subject category *Business and Management* (BAM) is the same as the original subject category *Alpha* as shown in Table 13. Even though this is the case, the *Alpha* is high enough to warrant leaving this content item in this subject category.

Table 12

Coefficient *Alpha* if Content Items Are Deleted in Subject Category J: FMT (Initial *Alpha* = .88)

| If Content Item Deleted | *Alpha* |
|---|---|
| Marketing in Graphic Communications (MKT) | .84 |
| Sales in Graphic Communications (SGC) | .84 |
| Customer Services in Graphic Communications (CSG) | .86 |
| Pricing, Costing, & Estimating Analysis (PCE) | .87 |
| Advertising (ADV) | .86 |
| Fundamental Economics in Graphic Communications (ECO) | .87 |
| E-Commerce/E-Business (ECB) | .87 |

Note. N = 98 to 99.

Table 13

Coefficient *Alpha* if Content Items Are Deleted in Subject Category K: BAM (Initial *Alpha* = .90)

| If Content Item Deleted | *Alpha* |
|---|---|
| Human Resources Management/Personal Leadership (HRM) | .87 |
| Fundamental Management in Graphic Communications (MGN) | .87 |
| Fundamental Finance in Graphic Communications (FIN) | .85 |
| Fundamental Accounting in Graphic Communications (ACC) | .86 |
| Organizational Management (OMT) | .88 |
| Business Law (LAW) | .90 |

Note. N = 97 to 98.

Table 14 and Table 15 are for content items in subject categories *Production Management* (PMT) and *Digital Media/Publishing* (DMP). Since the new *Alphas* are smaller than the original subject category *Alphas*, all content items appear to be internally consistent.

Table 14

Coefficient *Alpha* if Content Items Are Deleted in Subject Category L: PMT (Initial *Alpha* = .86)

| If Content Item Deleted | *Alpha* |
|---|---|
| Quality of Standards: ISO & ANSI (ISO) | .83 |
| Quality Assurance of Management (QAM) | .80 |
| Supervision in the Graphic Communications (SPN) | .81 |
| Printing Scheduling/Workflow (WKW) | .83 |

Note. N = 99.

Table 15

Coefficient *Alpha* if Content Items Are Deleted in Subject Category M: DMP (Initial *Alpha* = .86)

| If Content Item Deleted | *Alpha* |
|---|---|
| Streaming Video (STV) | .84 |
| E-Book (EBK) | .80 |
| Cross Media Publishing (CMP) | .80 |
| Digital & Web Publishing (WBP) | .82 |

Note. N = 97 to 98.

Summary of the internal consistency analysis. The analysis of the internal consistency for the content items within each of the 14 subject categories showed that the internal consistency was high enough in all cases to keep the content items in each subject category except subject category *Graphic Communications Past and Future*. However, content items identified as having low internal consistency were in the subject category *Basic Communication Techniques*. This may be useful information for content determination by curriculum specialists.

Table 16

Coefficient *Alpha* if Content Items Are Deleted in Subject Category N: COP (Initial *Alpha* = .77)

| If Content Item Deleted | *Alpha* |
|---|---|
| Database Management System (DMS) | .72 |
| Internet (INT) | .77 |
| Networking (NET) | .69 |
| Programming Language (PLG) | .72 |
| Information Systems/Information Technology (IST) | .71 |

Note. N = 98 to 99.

Research Question Four

Research question four was concerned with meaningful patterns among the subject category scales. Specifically, an analysis was done to see if any subject categories could be combined. Factor analysis, which was used for this process, is a collection of procedures for analyzing the relationship among variables for each individual of a group (Cureton & D'Agostino, 1983). For this study, the variables are the 14 subject categories.

Before the factor analysis is completed, a correlation matrix must be generated (see Table 17). For this study, a correlation matrix was completed for the subject categories.

In the factor analysis, many sub-analyses were conducted to ensure that this statistical procedure could be used for this study. The Kaiser-Meyer-Olkin index (KMO) was used to measure the sampling adequacy to show if data were likely to factor well or not ("Factor Analysis," 2001). The KMO index should be greater than .50 for a satisfactory factor analysis to proceed (Field, 2000; "How to perform," 2001). KMO

Table 17

Correlation Matrix for Subject Categories

| | SAM | CTE | GDN | PRE | PSS | DPT | POS | PAF | SAH | FMT | BAM | PMT | DMP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| B: CTE | 0.46 | | | | | | | | | | | | |
| C: GDN | 0.18 | 0.31 | | | | | | | | | | | |
| D: PRE | 0.16 | 0.25 | 0.43 | | | | | | | | | | |
| E: PSS | 0.11 | 0.18 | 0.03 | 0.40 | | | | | | | | | |
| F: DPT | 0.18 | 0.19 | 0.39 | 0.57 | 0.42 | | | | | | | | |
| G: POS | 0.19 | 0.23 | 0.26 | 0.53 | 0.51 | 0.53 | | | | | | | |
| H: PAF | 0.04 | 0.19 | 0.33 | 0.44 | 0.16 | 0.34 | 0.35 | | | | | | |
| I: SAH | 0.17 | 0.30 | 0.23 | 0.53 | 0.30 | 0.36 | 0.43 | 0.27 | | | | | |
| J: FMT | 0.14 | 0.29 | 0.34 | 0.37 | 0.25 | 0.47 | 0.61 | 0.35 | 0.41 | | | | |
| K: BAM | 0.22 | 0.38 | 0.19 | 0.36 | 0.36 | 0.37 | 0.57 | 0.33 | 0.49 | 0.71 | | | |
| L: PMT | 0.17 | 0.40 | 0.16 | 0.46 | 0.30 | 0.34 | 0.54 | 0.33 | 0.49 | 0.66 | 0.79 | | |
| M: DMP | 0.23 | 0.30 | 0.52 | 0.36 | 0.15 | 0.46 | 0.36 | 0.40 | 0.23 | 0.54 | 0.49 | 0.43 | |
| N: COP | 0.30 | 0.30 | 0.31 | 0.28 | 0.06 | 0.36 | 0.31 | 0.23 | 0.14 | 0.40 | 0.50 | 0.46 | 0.56 |

Note. Subject categories are corresponded to the questionnaire.

indices between .50 and .70 are considered mediocre, those between .70 and .80 are considered good, those between .80 and .90 are considered great, and those above .90 are considered superb (Hutcheson & Sofroniou, 1999). The KMO index in this study was .84, which means the sampling adequacy was confirmed, so the factor analysis could proceed.

The Bartlett's Test of Sphericity is another sub-analysis of factor analysis, and it "tests the null hypothesis that the original correlation matrix is an identity matrix" (Field, 2000, p. 6). The subject categories are highly significant since the associated probability of the Bartlett's Test of Sphericity is close to 0 ($p < 0.001$) in this study (see Table 17). Therefore, factor analysis for these variables was appropriate.

The communality of a variable is that proportion of its variance that can be accounted for by common factors, and this is another sub-analysis of factor analysis (Field, 2000; Kim & Mueller, 1978a; Lawley & Maxwell, 1971; "Principal component," 2001). In this study, the communality measures the percent of variance in a given variable explained by four factors jointly (explained later in this chapter) and shows that the variance in the subject categories has been accounted for by the extracted factors.

Table 18

KMO and Bartlett's Test

| | |
|---|---|
| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | .84 |
| Bartlett's Test of Sphericity | |
| Approximate Chi-Square | 582.21 |
| df. | 91 |
| Sig. | .001 |

Table 19 shows the communalities after extraction by using the Principal Component Analysis (PCA). It is the most preferred and widely used form of factor analysis as the extraction method (Lawley & Maxwell, 1971). Kim and Mueller (1978a, p. 84) state that extraction is "the initial stage of factor analysis in which the covariance matrix is resolved into a smaller number of underlying factors or components." The main objective of the extraction step "is exploratory factor analysis to determine the minimum number of common factors that would satisfactorily produce the correlations among the observed variables" (Kim & Mueller, 1978a, p. 84).

Table 19 shows that the subject categories PAF with .47 and SAH with .51 communality are the lowest communalities in the 14 subject categories. This means that only 47% and 51% of the variance of subject categories are shared by all of the other subject categories and that subject category BAM has 84% (the largest communality) of the variance which is accounted for by the extracted factors. This might indicate that the PAF and SAH subject categories measure slightly different constructs than the other subject categories ("Factor Analysis Using," 2001; Lawley & Maxwell, 1971).

Table 20 shows the factors extracted using factor analysis along with their initial eigenvalues, the percent of variance attributable to each factor, along with the cumulative variance of the factor and the previous factor. The eigenvalue, or characteristic root, for a given factor measures the variance in all of the variables accounted for by a given dimension of that factor ("Factor Analysis," 2001; Kim & Mueller, 1978a). This means that the ratio of eigenvalues may explain the importance of the factors with respect to the variables.

Table 19

Communalities of the Subject Categories

| Subject Categories | Communalities | N |
|---|---|---|
| A: Science and Mathematics (SAM) | .76 | 98 |
| B: Basic Communication Techniques (CTE) | .67 | 99 |
| C: Graphic Design (GDN) | .73 | 98 |
| D: Prepress (PRE) | .71 | 94 |
| E: Press (PSS) | .64 | 98 |
| F: Digital Printing Technology (DPT) | .61 | 99 |
| G: Postpress (POS) | .66 | 99 |
| H: Graphic Communications Past and Future (PAF) | .47 | 98 |
| I: Safety and Health (SAH) | .51 | 98 |
| J: Fundamental Marketing (FMT) | .73 | 98 |
| K: Business and Management (BAM) | .84 | 97 |
| L: Production Management (PMT) | .82 | 98 |
| M: Digital Media/Publishing (DMP) | .71 | 97 |
| N: Computer (COP) | .62 | 98 |

Note. Extraction Method: Principal Component Analysis.

When the eigenvalue was less than 1, those factors were excluded (Kim & Mueller, 1978a). Four factors were retained to meet the criterion since only they have eigenvalues higher than 1 (see Table 20). These four factors explain relatively large amounts of variance (especially Factor 1), whereas subsequent factors explain only small amounts of variance, Factor 1 explains 39.76%, Factor 2 explains 10.48%, Factor 3 explains 9.19%, and Factor 4 explains 8.38% (see Table 20). The four factors together explain 68 % of the variance.

The scree plot (see Figure 2) is a graph that shows the eigenvalues against all the factors. It is visual method for comparing the factors. As can be seen, the first four factors all have eigenvalues greater than 1.

Table 20

Eigenvalues for Factors Extracted

| | Initial Eigenvalues | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|---|---|---|---|---|---|---|---|---|---|
| Component | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 5.57 | 39.76 | 39.76 | 5.57 | 39.76 | 39.76 | 2.86 | 20.45 | 20.45 |
| 2 | 1.47 | 10.48 | 50.24 | 1.47 | 10.48 | 50.24 | 2.59 | 18.52 | 38.96 |
| 3 | 1.29 | 9.19 | 59.44 | 1.29 | 9.19 | 59.44 | 2.43 | 17.38 | 56.34 |
| 4 | 1.17 | 8.38 | 67.82 | 1.17 | 8.38 | 67.82 | 1.61 | 11.48 | 67.82 |
| 5 | 0.86 | 6.15 | 73.97 | | | | | | |
| 6 | 0.66 | 4.68 | 78.65 | | | | | | |
| 7 | 0.59 | 4.21 | 82.86 | | | | | | |
| 8 | 0.53 | 3.75 | 86.61 | | | | | | |
| 9 | 0.43 | 3.07 | 89.68 | | | | | | |
| 10 | 0.40 | 2.89 | 92.57 | | | | | | |
| 11 | 0.35 | 2.48 | 95.05 | | | | | | |
| 12 | 0.30 | 2.13 | 97.18 | | | | | | |
| 13 | 0.22 | 1.57 | 98.74 | | | | | | |
| 14 | 0.18 | 1.26 | 100.00 | | | | | | |

Note. . Extraction Method is Principal Component Analysis; N = 94 to 99.

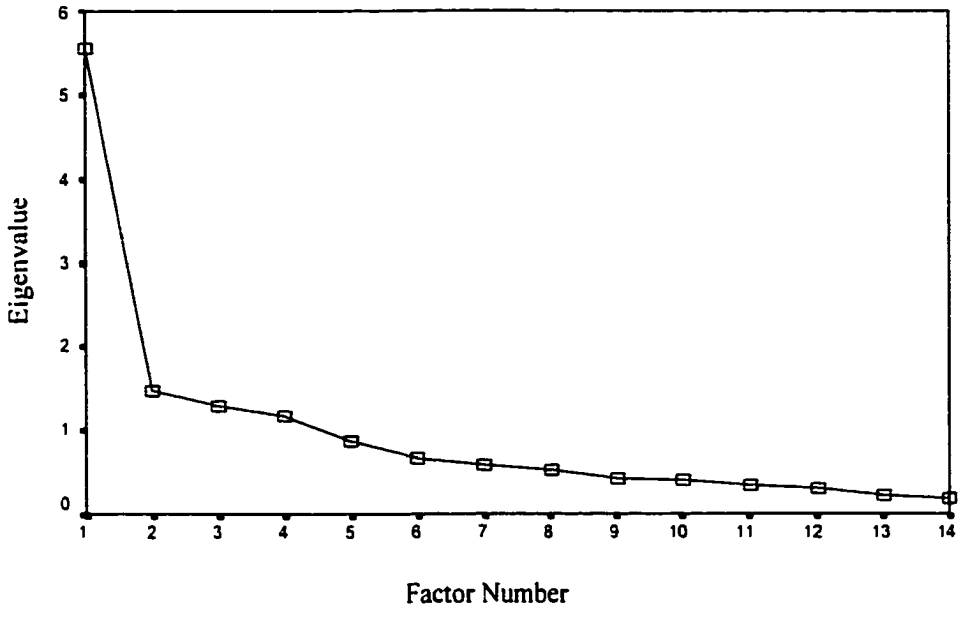



Figure 2. Scree Plot for the Subject Categories.

The Principal Component Analysis as an extraction method and the Varimax with Kaiser Normalization as a rotation method were conducted to show the Rotated Component Matrix. Extraction is used to determine the minimum number of common factors that satisfactorily produce the correlations among the observed variables (Kim & Mueller, 1978a). The rotation method helps to make the interpretation of the analysis easier ("How to Perform," 2001). This identifies how many factors should be retained and what subject categories should be combined into one factor. The idea of rotation is to reduce the number of factors for which the variables under investigation have high loading.

Common social science practice uses a minimum cut-off of .30 to .50 (for Likert-scales, a .60 might be considered high) of absolute value as a factor loading ("Factor

Analysis," 2001; "Factor Analysis Using," 2001; "How to Perform," 2001). The higher the absolute value of the loading, the more the factor contributes to the variable ("How to Perform," 2001). In this study, the criterion for a variable (subject category) being included in a factor was a loading of .53 or greater since a type of Likert-scale was used. Only factors above .53 are displayed in Table 21 to ensure clarity.

Table 21, the Rotated Component Matrix, shows the reduced components and subject categories. Gorsuch (1974) states that each factor "represents an area of generation that is a qualitative distinction from that represented by any other factor" (p. 3). It can be concluded that the subject categories FMT, BAM, PMT, and COP are substantially and strongly loaded on Factor one, since this factor has a high eigenvalue (5.57). The other factors are weakly loaded to the corresponding factors because of their low eigenvalues. The subject categories PRE, PSS, DPT, POS, and SAH are substantially loaded on Factor two (eigenvalue: 1.47), categories GDN, PAF, and DMP on Factor three (eigenvalue: 1.29), and categories SAM and CTE on Factor four (eigenvalue: 1.17).

Combining subject categories. Factor one includes the subject categories *Fundamental Marketing* (FMT), *Business and Management* (BAM), *Production Management* (PMT), and *Computer* (COP). As can be observed, the subjects concern business, marketing, computer, and management, and they are strongly correlated to each other. If these are combined a possible new subject category would be "*Business and Computers*."

Factor two includes the subject categories *Prepress* (PRE), *Press* (PSS), *Digital Printing Technology* (DPT), *Postpress* (POS), and *Safety and Health* (SAH). The contents in Factor two appear to be related to the broad subject of graphic communications. If these are combined a possible new subject category would be "*General Graphic Communications.*"

Table 21

Rotated Component Matrix

| Categories | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|
| A: SAM | | | | .86 |
| B: CTE | | | | .76 |
| C: GDN | | | .82 | |
| D: PRE | | .68 | | |
| E: PSS | | .79 | | |
| F: DPT | | .56 | | |
| G: POS | | .65 | | |
| H: PAF | | | .58 | |
| I: SAH | | .63 | | |
| J: FMT | .74 | | | |
| K: BAM | .87 | | | |
| L: PMT | .82 | | | |
| M: DMP | | | .71 | |
| N: COP | .53 | | | |

Note. Extraction Method: Principal Component Analysis; Rotation Method: Varimax with Kaiser Normalization.

Factor three includes the subject categories *Graphic Design* (GDN), *Graphic Communications Past and Future* (PAF), and *Digital Media/Publishing* (DMP). This factor contains graphic design, publishing, electronic media, and the past and future of graphic communications. Based on observation, GDN and DMP can possibly be

combined but PAF is not a logical fit in this category. If GDN and DMP were combined, a possible new subject category would be "*Graphic Design and Cross Media Publishing.*"

Factor four includes the subject categories *Science and Mathematics* (SAM) and *Basic Communication Techniques* (BCT). The contents in Factor four are the knowledge and topics of general science, mathematics, and communication techniques, such as writing. If these are combined a possible new subject category would be "*Science, Mathematics, and Communication Skills.*"

Based on the factor analysis, four factors were identified with eigenvalues above 1, meaning that these could be further analyzed to determine if the subject categories making up each factor could be logically combined. Using this process, four subject categories were subjectively created including *Business and Computers*; *General Graphic Communications*; *Graphic Design and Cross Media Publishing*; and *Science, Mathematics, and Communication Skills.* The only change from the four factors identified in the factor analysis was placing PAF in the *General Graphic Communications* category instead of *Graphic Design and Cross Media Publishing.* When the subject category *Others* is included, this makes a total of five subject categories.

## Summary

This study involved analysis of responses from an Expert Panel and graphic communications faculty. The Expert Panel identified 68 content items in 15 subject categories that are deemed to be important in graphic communications programs. This

content was placed in a questionnaire and sent to graphic communications faculty. Ninty-nine of 156 surveys returned and were used for statistical analysis.

Responses from the educators were presented using means and standard deviations for content items. Further, reliability (Cronbach's Coefficient *Alpha*) was used to check the internal consistency of those content items within each subject category, and factor analysis was used to provide ideas for combining subject categories.

# CHAPTER V

# SUMMARY, CONCLUSIONS, DISCUSSION, AND RECOMMENDATIONS

## Summary

This study investigated important content for undergraduate graphic communications programs in four-year colleges and universities. Content was initially identified by a panel of experts (two rounds). This content was then rated in importance by graphic communications faculty in four-year colleges and universities. Statistical analysis was completed to determine if content items within subject categories were internally consistent (Cronbach's Coefficient *Alpha*) and to determine if subject categories could be combined (factor analysis).

Four research questions guided this study. They are as follows:

1. What content is important for undergraduate graphic communications programs as determined by a review of the literature and an Expert Panel?

2. By category and individual item within each subject category, what is the level of importance, as rated by graphic communications faculty, for content making up an undergraduate graphic communications program?

3. What is the evidence of reliability, as judged by the internal consistency, for each of the subject category scales?

4. What meaningful patterns can be found among the correlations of the subject category scales?

Additionally, the demographic information for graphic communications faculty was obtained and reported. This provided a description of participants in the study.

For research question one, important content for a general graphic communications program was identified by a panel of experts (two rounds). Fifteen subject categories were identified and 68 content items within these 15 subject categories. All of these items were rated by the panel as being important.

For research question two, graphic communications faculty rated the importance of subject categories and content items identified by the panel of experts. Ten subject categories were rated 4.0 (fairly high importance) or above. Five of the subject categories were rated between 3.31 and 3.96, with 3.0 being moderate importance. These ratings support the experts' perceptions of these subject categories.

Based on the ratings for content items by faculty, all except three of the content items are considered to be of moderate importance to fairly high importance. The three items that received a mean rating below 3.0 were still above 2.5 (between low and moderate importance). These three items included *Calculus* ($\underline{M}$ = 2.56), *Programming Language* ($\underline{M}$ = 2.72), and *Finite Mathematics* ($\underline{M}$ = 2.82). The subject categories that contained these content items received a mean score of 3.31 or above.

For research question three, the internal consistency of content items within each subject category were analyzed. Only 14 subject categories were used since the *Other* subject category, by its nature, contained diverse content. The analysis of the internal consistency for the content items within each of the 14 subject categories showed that the internal consistency was high enough in all cases to keep the content items in each subject category except subject category *Graphic Communications Past and Future.* Even though, the internal consistency was high enough to retain the content items, those

items in the subject category *Basic Communication Techniques* were the least internally consistent. This may be useful information for content determination by curriculum specialists.

For research question four, a factor analysis was completed to determine if some subject categories could be combined. Using this process, four factors were identified with eigenvalues above 1, meaning that these could be further analyzed to determine if the subject categories making up each factor could be logically combined. Based on a subjective analysis of the subject categories, four subject categories were created and named by the researcher as *Business and Computers*; *General Graphic Communications*; *Graphic Design and Cross Media Publishing*; and *Science, Mathematics, and Communication Skills*. The only change from the four factors identified in the factor analysis was placing *Graphic Communications Past and Future* (PAF) in the *General Graphic Communications* category instead of *Graphic Design and Cross Media Publishing*.

When the subject category *Others* is included, this makes a total of five subject categories. Since subject category combinations and titles were completed in a subjective manner, these might require further validation.

## Conclusions

Based on the findings of this study, the following conclusions can be made.

1. The 15 subject categories and 68 content items, as identified by a panel of experts are important items for consideration within a general undergraduate graphic communications program. The only content items that might require further

consideration are *Calculus*, *Programming Language*, and *Finite Mathematics* since these received a rating below moderately important.

2. Content items within the subject categories showed internal consistency and so are believed to be closely related to one another except content items *History of Graphic Communications* and *Current Developments and Trends in Graphic Communications* in subject category *Graphic Communications Past and Future.*

3. A possible change in subject categories would be to merge the 15 subject categories into five subject categories. These include *Business and Computers*; *General Graphic Communications*; *Graphic Design and Cross Media Publishing*; *Science, Mathematics, and Communication Skills*; and *Others.*

## Discussion

Important graphic communications content was identified by an Expert Panel and rated in importance by graphic communications faculty nationwide. Responses by faculty were statistically analyzed to determine if the 68 content items in 15 subject categories were appropriate.

Even though the Expert Panel was given two opportunities to change and rate subject categories and content items, it might be useful to increase the size of the Expert Panel and complete a Delphi study which would result in additional refinement of subject categories and content items. It might also be helpful to compare the ratings by the Expert Panel and faculty.

It is interesting to note that some categories were rated as fairly high in importance (4.0) by both the Expert Panel and faculty. Theses include *Basic*

*Communication Techniques*, *Graphic Design*, *Prepress*, and *Others*. The subject category *Prepress* was the only subject category rated above 4.5 by both the Expert Panel and faculty. Within the subjcet category *Prepress*, five of the six content items were rated above 4.5 including *Preflighting*; *Imaging Acquisition and Editing*; *Composition/Imposition*; *Color Reproduction and Separation*; *Electronic Prepress (Publishing) System and Desktop Publishing System*; and *Color Management System*. It appears that this subject category deserves attention when designing a program.

Three subject categories were rated below 4.0 by both the Expert Panel and faculty. These include *Science and Mathematics*, *Fundamental Marketing*, and *Computer*. The *Computer* category contains content items, such as *Database*, *Networking*, *Programming Language*, *Information Systems/Information Technology*, and *Internet*. It appears that *Internet* is rated as fairly high in importance but the others in this category are considered less important.

It is observed that many content items identified as important for graphic communications program are concerned with newer technologies. This is reflection of the changes occurring in industry and perhaps a reflection of students' interests as well.

Management in graphic communications is playing a more important role than in the past according to this study. Two subject categories are related to management, which are *Production Management* and *General Management*. *Production Management* is perceived by faculty as being more important than *General Management*. When individual content items within the *General Management* category are analyzed, it is noted that several of these content items received comparatively low ratings by faculty.

including *Finance*, *Accounting*, and *Law*. However, these content items certainly deserve consideration for curriculum change since graphic communications is a business which has financial and legal responsibilities.

For undergraduate students, it is necessary to complete approximately 130 semester credits (including general education) for accomplishing a bachelor's degree. There are 68 content items within 15 subject categories that were identified in this study which covers very broad subject areas in graphic communications. Curriculum designers will obviously need to prioritize when determining what content should be included in a graphic communications program.

## Recommendations

The recommendations for this study are made based on the findings.

1. Further research could be conducted to determine if level of importance for content items remains the same over time. Further, this will provide additional data on those content items that received a rating below moderate importance in this study.

2. The content items in the subject category *Others* were believed to not belong in any other subject category. Further research is needed to provide corroboration of this conclusion.

3. Even though internal consistency for content items was considered high enough to leave the content items in each subject category, some internal consistency coefficients were borderline. Further research would help in confirming that content items should remain in each subject category.

4. After the factor analysis, five subject categories were subjectively determined. These should be considered tentative, and further research would be needed to validate these subject categories.

5. Each program will need to prioritize subject categories and content items for their curriculum.

6. There are different kinds of graphic communications programs. Research could be conducted that focuses on each type of program, such as management, technology, or design.

7. This study might be duplicated with industry personnel as well as students to compare their perceptions with those of faculty.

8. This same study could be used for conducting research in different countries. This can provide information about differences in cultures.

9. Because content keeps changing, a similar graphic communications program study should be done every few years.

10. Three methods were used in this study for data collection, including a mail questionnaire, a follow-up e-mail reminder that included the survey as an attachment that could be printed as well as a hyperlink to a personal website where the survey could be completed. This combination method was an effective way to increase response rate for this study. Further research is needed to corroborate this finding.

# REFERENCES

Allen, R. E. (1990). The concise Oxford dictionary of current English (8th ed.). Oxford, England: Clarendon Press.

Alreck, L. P., & Settle, R. B. (1995). The survey research handbook (2nd ed.). Chicago: Richard D. Irwin, Inc.

Anderson, M., Eisley, W., Howard, A., Romano, F., & Witkowski, M. (1998). PDF printing and publishing: The next revolution after Gutenberg (2nd ed.). Torrance, CA: Micro Publishing Press.

Ariza, E. N., Knee, R. H., & Ridge, M. L. (2000, May). Uniting teachers to embrace 21st century technology. THE Journal, 27(10), 22.

Ary, D., Jacobs, L. C., & Razavieh, A. (1990). Introduction to research in education (4th ed.). Orlando, FL: Holt, Rinehart and Winston, Inc.

Babbie, E. (1990). Survey research methods (2nd ed.). Belmont, CA: Wadsworth, Inc.

Bailey, K. D. (1987). Methods of social research (3rd ed.). New York: Free Press.

Balian, E. S. (1982). How to design, analyze, and write doctoral research: The practical guidebook. New York: University Press of America.

Balsley, H. L., & Clover, V. T. (1988). Research for business decisions: Business research methods (4th ed.). Columbus, OH: Publishing Horizons.

Behling, J. H. (1976). Research methods: Statistical concepts and research practicum. Millburn, NJ: RF Publishing, Inc.

Bobbitt, F. (1997). Scientific method in curriculum-making. In D. J. Flinders & S. J. Thornton (Eds.), The curriculum studies reader (pp. 9-16). New York: Routledge.

Borg, W. R., & Gall, M. D. (1989). Educational research: An introduction (5th ed.). New York: Longman.

Broudy, D., & Romano, F. (1999). Personalized & database printing: The complete guide. Torrance, CA: Micro Publishing Press.

Callahan, M. R. (Ed.). (1996). Essentials for evaluation. Alexandria, VA: American Society for Training and Development.

Campbell, L. (2001, September). The road to gold. American Printer, 227(6), 26.

Child, D. (1970). The essential of factor analysis. London: Holt, Rinehart and Winston.

Clark, R. E., & Sugrue, B. M. (1990). New techniques for effective training management. Los Angeles: University of Southern California Press.

Cohen, L., & Manion, L. (1985). Research methods in education (2nd ed.). London: Croom Helm.

Comrey, A. L. (1973). A first course in factor analysis. New York: Academic Press.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. Journal of Applied Psychology, 78(1), 98-104.

Cost, F. (1997). Pocket guide to digital printing. New York: Delmar Publishers.

Crim, E. (1998, January). Who's making variable profitable? American Printer, 220(4), 34-36.

Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. Psychometrika, 16, 297-334.

Crowl, T. K. (1986). Fundamentals of research: A practical guide for educators and especial educators. Columbus, OH: Publishing Horizons.

Cureton, E. E., & D'Agostino, R. B. (1983). Factor analysis: An applied approach. Hillsdale, NJ: Lawrence Erlbaum Associates.

Dailey, D. W. (2000). A wake-up call for graphic communications education. GATF Technology Forecast: Technology trends for the new millennium. Sewickley, PA: GATF Press.

Digital roadmaps: Computer-to-Plate technology. Retrieved January 31, 2000, from the World Wide Web: http://www.agfahome.com/roadmaps/whitepapers/home.html

Dillman, D. A. (1978). Mail and telephone surveys: The total design method. New York: John Willey & Sons.

Ediger, M. (1995, Winter). Subject centered versus and activity centered curriculum. Education, 116(2), 268-270.

Esler, B. (1995, September). Can-do for canned goods. Graphic Arts Monthly, 67(9), 90-92.

Factor analysis. Retrieved April 2, 2001, from the World Wide Web: http://www2.chass.ncsu.edu/garson/pa765/factor.htm

Factor analysis using SAS PROC factor. (1995, June 26). Retrieved April 2, 2001, from the World Wide Web: http://www.utexas.edu/cc/docs/stat53.html

Farmer, J. (1997). Using technology. In J. G. Gaff, J. L. Ratcliff, & Associates (Eds.), Handbook of the undergraduate curriculum: A comprehensive guide to purposes, structures, practices, and change (pp. 476-492). San Francisco: Jossey-Bass.

Fenton, H. (2000, September 25). On-demand printing: Show me the money. Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

Ferren, A. S. (1997). Achieving effectiveness and efficiency. In J. G. Gaff, J. L. Ratcliff, & Associates (Eds.), Handbook of the undergraduate curriculum: A comprehensive guide to purposes, structures, practices, and change (pp. 533-557). San Francisco: Jossey-Bass.

Ferris, F. (1994, March). Hitting new heights. American Printer, 212(6), 32-35.

Field, A. P. (2000). Discovering statistics using SPSS for Windows: advanced techniques for the beginner: Factor analysis using SPSS. Retrieved April 20, 2001, from the World Wide Web: http://www.cogs.susx.ac.uk/users/andyf/teaching/rm2/factor.pdf

Flecker, S. A., & Groff, P. J. (1998). Careers in graphic communications: A resource book. Sewickley, PA: GATF Press.

Flexner, S. B., & Hauck, L. C. (1993). Random house unabridged dictionary (2nd ed.). New York: Random House.

Fowler, F. J. Jr. (1993). Survey research methods (2nd ed.). Newbury Park, CA: Sage Publications.

Fricke, R. (1999, July/August). Houston conference offers environmental solutions. GATF World, 11(4), 35-37.

Gall, M. D., Borg, W. R., & Gall, J. P. (1996). Educational research: An introduction (6th ed.). New York: Longman.

Gall, J. P., Gall, M. D., & Borg, W. R. (1999). Applying educational research: A practical guide (4th ed.). New York: Addison Wesley Longman.

Goff, L. (1997, June 16). Workforce outlook: Skilled for today or tomorrow? Computerworld, 31(24), 101.

Gorsuch, R. L. (1974). Factor analysis. Philadelphia: W. B. Saunders Company.

Gove, P. B. (Ed.). (1981). Webster's third new international dictionary of the English language unabridged. Springfield, MA: G. & C. Merriam Company.

Griffin, L., Dodds, P., & Rovegno, J. (1996, November-December). Pedagogical content knowledge for teachers. The Journal of Physical Education, Recreation & Dance, 67(9), 58-61.

Harman, H. H. (1976). Modern factor analysis (3rd ed., Rev. ed.). Chicago: The University of Chicago Press.

Harper, E. (2000, September). Getting down to business with digital printing. Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

Hecker, D. (1998, Summer). Occupations and earnings of workers with some colleges but not degree. Occupational Outlook Quarterly, 42(2), 29-39.

Hilts, P. (1997, July). The road ahead. Publishers Weekly, 244(31), 125-128.

How to perform and interpret factor analysis using SPSS. Retrieved April 2, 2001, from the World Wide Web: http://www.ncl.ac.uk/ucs/statistics/common/specialisttopics/factor_analysis/factoranalysis.html

Hunkins, F. P. (1980). Curriculum development: Program improvement. Columbus, OH: Charles E. Merrill Publishing Company.

Hutcheson, G. D., & Sofroniou, N. (1999). The Multivariate Social Scientist : Introductory Statistics Using Generalized Linear Models. Thousand Oaks, CA: Sage Publications.

Job definition format: JDF white paper. Retrieved September 5, 2000, from the World Wide Web: http://www.job-definition-format.org/jdf_wp.pdf

Johnson, C. D. (1981). A descriptive study of important energy conservation content for industrial arts in North Carolina and potential constraints to implementation of the content. Unpublished doctoral dissertation, North Carolina State University, Raleigh, NC.

Keller, G., & Warrack, B. (2000). Statistics for management and economics (5th ed.). Pacific Grove, CA: Duxbury.

Kelly, A. V. (1989). The curriculum: Theory and practice (3rd ed.). London: Paul Chapman Publishing.

Kendall, J. S., & Marzano, R. J. (2000). Content knowledge (2nd ed.). Aurora, CO: Mid-Contient Regional Educational Laboratory.

Kibble, P. (1995, September 6). A better way to manage resources. PC User, 266, 114-115.

Kim, J., & Mueller, C. W. (1978a). Factor analysis: Statistical methods and practical issues. Beverly Hills, CA: Sage Publication.

Kim, J., & Mueller, C. W. (1978b). Introduction to factor analysis: What it is and how to do it. Beverly Hills, CA: Sage Publication.

Kuo, W., & Deuermeyer, C. (1998, June). The IE curriculum revisited: Developing a new undergraduate program at Texas A&M University. IIE Solutions, 30(6), 16-22.

Kurian, G. T., & Molitor, G. T. (Eds.). (1996). Encyclopedia of the future. New York: Simon & Schuster Macmillan.

Lang, G., & Heiss, G. D. (1984). A practical guide to research methods (3rd ed.). New York: University Press of America.

Lawley, D. N., & Maxwell, A. E. (1971). Factor analysis as a statistical method. New York: American Elsevier Publishing.

Leland, L. (1999, February). Online for success. American Printer, 222(5), 54-57.

Levenson, H. R. (2000). Understanding graphic communications: Selected readings. Sewickley, PA: GATF Press.

Levine, A. (1978). Handbook on undergraduate curriculum. San Francisco: Jossey-Bass.

Lindquist, J. (1978). Strategies for change. Berkeley, CA: Pacific Soundings Press.

Margolis, S. W. (2000, September). Improve profitability: When numbers talk, are you listening? Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

Markert, L. R. (1997). Contemporary technology: Innovations, issues, and perspectives. Tinley Park, IL: Goodheart-Willcox.

Marsh, C., & Willis, G. (1995). Curriculum: Alternative approaches, ongoing issues. Englewood, NJ: Prentice Hall.

Marshall, S., & Zoratti, S. (1999, September/October). Are you ready for the global revolution? GATF World, 11(5), 21-25.

Martin, G. E. (Ed.). (1979). Industrial arts education: Retrospect, prospect. Bloomington, IL: American Council on Industrial Arts Teacher Education.

McMillan, J. H. (2000). Educational research: Fundamentals for the consumer (3rd ed.). New York: Addison Wesley Longman, Inc.

McMillan, J. H., & Schumacher, S. (1997). Research in education: A conceptual introduction (4th ed.). New York: Addison Wesley Longman, Inc.

Mission possible. (1994, July). American Printer, 213(4), 87-88.

Mitcham, W. D. (1994). Thinking through technology: The path between engineering and philosophy. Chicago: University of Chicago Press.

Mittelhauser, M. (1998, Summer). The outlook for college graduates, 1996-2006: Prepare yourself. Occupational Outlook Quarterly, 42(2), 3-9.

Mondy, R. W., & Premeaux, S. R. (1995). Management: Concepts, practices and skills (7th ed.). Englewood Cliffs, NJ: Prentice Hall.

Morgan, R. L., & Hunt, E. S. (2000, October). Classification of instructional programs 2000. Washington, DC: U.S. Department of Education.

Morse, W. A., & Corcoran-Perry, S. (1996, November). A process model to guide selection of essential curriculum content. Journal of Nursing Education, 35, 341-347.

Nunnaly, J. C. (1978). Psychometric theory (2nd ed.). New York: McGraw-Hill.

O'Brien, K. (1997, August). Printing that's as good as it gets. American Printer, 219(5), 36-37.

Olson, D. (1958). Technology and industrial arts. Unpublished doctoral dissertation, Ohio State University, Columbus.

Pacey, A. (1996). Technology in world civilization (5th ed.). Cambridge, MA: MIT Press.

Paparozzi, A. (2000, September). Anticipating future print demand. Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

Payne, N. (1988). Human resources management. In D. Saltman, N. M. Yancey, & S. M. Masterton (Eds.), Management guide: For printers and publishers (pp. 12:1-10). Arlington, VA: Association of Graphic Arts Consultants.

Pratt, D. (1980). Curriculum: Design and development. New York: Harcourt Brace Jovanovich.

Principal components and factor analysis. Retrieved April 2, 2001, from the World Wide Web: http://www.statsoftinc.com/textbook/stfacan.html

Print procurement dot-com firm takes acquisition approach. Graphic Arts Monthly. Retrieved September 27, 2000, from the World Wide Web: http//:www.gammag.com/Current/index2(9_25_00).html

Printing and publishing. (1999, April). U.S. industry & trade outlook 1999. New York: McGraw-Hill Companies.

Printing and publishing. (2000, April). U.S. industry & trade outlook 2000. New York: McGraw-Hill Companies.

Ratcliff, J. L. (1990, May). Development and testing of a cluster-analytic model for identifying coursework patterns associated with general learned abilities of college students: Final report. U.S. Department of Education, Office of Education Research and Improvement, Research Division. University Park: Center for the Study of Higher Education, Pennsylvania State University.

Ratcliff, J. L. (1997). What is a curriculum and what should it be? In J. G. Gaff, J. L. Ratcliff, & Associates (Eds.), Handbook of the undergraduate curriculum: A comprehensive guide to purposes, structures, practices, and change (pp. 5-29). San Francisco: Jossey-Bass.

Reliability. Retrieved April 30, 2001, from the World Wide Web: http://www2.chass.ncsu.edu/garson/pa765/reliab.htm

Reliability and item analysis. Retrieved April 30, 2001, from the World Wide Web: http://www.statsoftinc.com/textbook/streliab.html

Romano, F. (1997). The printing industry. Digital printing report, 4(1), 1-4.

Romano, F. J. (1999a). PDF printing and workflow. Englewood, NJ: Prentice Hall.

Romano, F. J. (1999b, October). Printing press or digital printer: Which will win? Paper presented at the seminar of Graph Expo 99 and Converting Expo 99, Chicago.

Romano, F. J. (1999c). Digital printing and the future of print. Technical Association of the Graphic Arts Newsletter, 132, 4 & 9.

Romano, F. J. (2000a). Digital printing: Mastering on-demand and variable data printing for profit. San Diego, CA: Windsor Professional Information, LLC.

Romano, F. J. (2000b, September 25). Trends in printers, copiers, and presses. Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

Romano, R. M., & Romano, F. J. (Eds.). (1998). The GATF encyclopedia of graphic communications. Sewickley, PA: GATF Press.

Roth, J. (1993, November). Editor's desk. American Printer's, 212(2), 8.

Roth, J. (2000, September). Managing the printing operation in times of change. Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

Ruggles, P. K. (1991). Printing estimating (3rd ed.). Albany, NY: Delmar Publishers Inc.

Rummel, R. J. (1970). Applied factor analysis. Evanston, IL: Northwestern University Press.

Ryan, G. (2000, August 3). 2000 Technology trends. Paper presented at the Annual Conference of the International Graphic Arts Education Association, Williamsport, PA.

Santos, J. R. (1999, April). Cronbach's alpha: A tool for assessing the reliability of scales. Journal of Extension, 37(2). Retrieved April 2, 2001, from the World Wide Web: http://joe.org/joe/1999april/tt3.html

Sarkans, I. (1988). Job shop production planning and scheduling. In D. Saltman, N. M. Yancey, & S. M. Masterton (Eds.), Management guide: For printers and publishers (pp. 24:1-46). Arlington, VA: Association of Graphic Arts Consultants.

Saylor, J. G., Alexander, W., & Lewis, A. (1981). Curriculum planning for better teaching and learning (4th ed.). New York: Holt, Rinehart and Winston.

Schildgen, T. E., Benham, F., Leastar, D., & Jose, B. (1998). Pocket guide to color with digital applications. New York: Delmar Publishers.

Schmidt, K. F. (2000, May). Print for one. Print, 54(3), 113.

Sharples, H. (1998, April). Digital printers bet on innovation. Graphic Arts Monthly, 70(4), 66-69.

Siegel, A. A. (1954). Procedure for determining an industrial arts program. Unpublished doctoral dissertation, Columbia University, New York.

Skeel, D. J., & Hagen, O. A. (1971). The process of curriculum change. Pacific Palisades, CA: Goodyear Publishing.

Slaren, J. R. (1994). A comparison of school board members' and superintendents' ethical reasoning processes. Paper presented at the annual meeting of the Southwest Education Research Association, San Antonio, TX.

Sudman, S. A., & Bradburn, N. M. (1982). Asking questions: A practical guide to questionnaire design. San Francisco: Jossey-Bass.

The outlook for PDF. (1997, September). American Printer, 219(6), 84.

Tobias, A. J. (1996, October 28). Co-op programs aid students, employers. Electronic Engineering Times, 925, C16.

Tolliver-Nigo, H. (1998, December). Choosing digital proofer. Electronic Publishing, 22(12), 24-31.

Toombs, W., & Tierney, W. (1991). Meeting the mandate: Renewing the college and departmental curriculum. SSHE-ERIC Higher Education Report No. 6. Washington, DC: School of Education and Human Development, George Washington University.

Tuckman, B. W. (1988). Conducting educational research (3rd ed.). Orlando, FL: Harcourt Brace Jovanovich, Inc.

Tukey, J. W. (1977). Exploratory data analysis. Reading, MA: Addison-Wesley Publication Company.

Tyler, R. W. (1949). Basic principles of curriculum and instruction. Chicago: University of Chicago Press.

Tyler, R. W. (1975). Specific approaches to curriculum development. In J. Schaffarzick & D. Hampton (Eds.), Strategies for curriculum development (pp. 325-359). Berkeley, CA: McCutchan.

Veysey, L. (1965). The emergence of the American university. Chicago: University of Chicago Press.

Vision 21: The printing industry redefined for the 21st century. (2000). Sewickley, PA: Printing Industries of America.

Voelker, A. M. (1973). Research on concept learning: An analysis. Occasional Paper Series, Science Paper #11. Columbus, OH: Eric Center for Science, Math, and Environmental Education.

Webb, J. W. (1999a). The effect of the Internet on print demand. TrendWatch special report for Commercial Printing 2010. Harrisville, RI: TrendWatch.

Webb, J. W. (1999b, October). TrendWatch: Trends that affect you and your business. Paper presented at the seminar of Graph Expo 1999 and Converting Expo 1999, Chicago.

Webb, J. W. (2000, September 24). TrendWatch: Trends that affect you and your business. Paper presented at the seminar of Graph Expo 2000 and Converting Expo 2000, Chicago.

White, M. R. (1987). Selecting a technical research design. In E. N. Israel & R. T. Wright (Eds.), Conducting technical research 36th yearbook (pp. 68-87). Mission Hills, CA: Glencoe.

Wiersma, W. (1991). Research methods in education: An introduction (5th ed.). Needham Height, MA: Allyn and Bacon.

Winzeler, J. H. (1997, May). Education is a business investment. Techniques, 71(5), 62.

Wise, A. E. (1979). Legislated learning: The bureaucratization of American classroom. Berkeley: University of California Press.

Worldwide printing to reach $1 trillion. (2000, June 20). Business Forms, Labels & System, 38(6), 38.

Zwang, D. L. (1998, December). Technology on the horizon. American Printer, 222(3), 54-57.

# APPENDIX A

## TAGA: TECHNICAL ASSOCIATION OF THE GRAPHIC ARTS

## TAGA: Technical Association of the Graphic Arts

Technical Association of the Graphic Arts was organized in 1948. TAGA is the only global professional technical association for the graphic arts industries, and maintains the industry's best permanent set of technical papers and abstracts. TAGA also provides guidance and support to its 15 active Student Chapters around the world. It provides a worldwide forum for sharing and disseminating theoretical, functional, and practical information on current and emerging technologies for Graphic Arts print production and related processes.

There are 28 active and inactive Student Chapters in TAGA from all over the world including Austria, Canada, France, Sweden, Taiwan, Thailand, and the United Kingdom. TAGA is one of the biggest organizations for graphic communications students. TAGA offers Student Chapter Publication Contest Awards, Graduate and Undergraduate Student Paper Competition Awards, and Student Poster Paper Competition Awards each year in the graphic communications community for educators and students. In addition, TAGA sponsors many scholarships and fellowships each year to deserving graphics communications students. TAGA also has an annual student meeting and annual conference. During the student meeting, the students can discuss their ideas, past, present, and future chapter activities, ideas for fundraising and member recruitment, and other timely issues each year. A lot of research papers are presented at the Annual Conference, and are published in the TAGA Proceedings. Those graphic communications programs in TAGA's Students Chapters play a vital role because they actively participate in the graphic communications community.

# APPENDIX B

## THE QUESTIONNAIRE FOR THE EXPERT PANEL

## Questionnaire for Graphic Communications Curriculum

**Overview**: This questionnaire is concerned with important content for comprehensive undergraduate graphic communications programs. Your opinions will be greatly appreciated.

**Directions**: There are 14 categories in the following list. Please rate the content items regarding your belief on ***how important*** each item is as part of a comprehensive graphic communications a program at the undergraduate level. Each item is rated on a 1 to 5 scale, with 1 being no importance, and 5 being very high importance.

Please make any comments about the categories or content items directly on the form. Also, if you believe other content should be included, please add it and rate each item. There is a section at the end of the questionnaire for any other comments you may wish to make.

**1: No Importance; 2: Low Importance; 3: Moderate Importance; 4: Fairly High Importance; 5: Very High Importance**

## *Subject Categories and Content Items*

*(Please circle the appropriate Importance into numbers)*

| Subject Area (Category) and Content Items of GC Programs | Importance Rating |
|---|---|
| **A. Science & Mathematics** | |
| 1. General Chemistry | 1 2 3 4 5 |
| 2. General Physics | 1 2 3 4 5 |
| 3. College Mathematics: Algebra/Trigonometry | 1 2 3 4 5 |
| 4. Finite Mathematics | 1 2 3 4 5 |
| 5. Calculus | 1 2 3 4 5 |
| 6. General Statistics | 1 2 3 4 5 |
| 7. Other? | 1 2 3 4 5 |
| 8. Other? | 1 2 3 4 5 |
| | |
| **B. Basic Communication Techniques** | |
| 1. Technical Writing | 1 2 3 4 5 |
| 2. Oral Communications & Speech | 1 2 3 4 5 |
| 3. Interpersonal Communications Skills | 1 2 3 4 5 |
| 4. Business & News Writing | 1 2 3 4 5 |
| 5. Other? | 1 2 3 4 5 |
| 6. Other? | 1 2 3 4 5 |
| | |
| **C. Graphic Design** | |
| 1. Principles of Page Layout & Design | 1 2 3 4 5 |
| 2. Illustration & Computer Graphics | 1 2 3 4 5 |
| 3. Multi-Media: Presentation & Animation Software | 1 2 3 4 5 |
| 4. Other? | 1 2 3 4 5 |

| | |
|---|---|
| 5. Other? | 1 2 3 4 5 |
| | |
| **D. Prepress** | |
| 1. Preflighting | 1 2 3 4 5 |
| 2. Film & Digital Imaging & Editing (e.g. image scanning) | 1 2 3 4 5 |
| 3. Color Reproduction & Separation | 1 2 3 4 5 |
| 4. Composition/Imposition | 1 2 3 4 5 |
| 5. Electronic Prepress (Publishing) System & Desktop Publishing System | 1 2 3 4 5 |
| 6. Color Management System | 1 2 3 4 5 |
| 7. Other? | 1 2 3 4 5 |
| 8. Other? | 1 2 3 4 5 |
| | |
| **E. Press** | |
| 1. Lithography Process | 1 2 3 4 5 |
| 2. Gravure Process | 1 2 3 4 5 |
| 3. Flexography Process | 1 2 3 4 5 |
| 4. Screen Process | 1 2 3 4 5 |
| 5. Other? | 1 2 3 4 5 |
| 6. Other? | 1 2 3 4 5 |
| | |
| **F. Postpress** | |
| 1. Binding/Finishing Process | 1 2 3 4 5 |
| 2. Packaging Process | 1 2 3 4 5 |
| 3. Fulfillment | 1 2 3 4 5 |
| 4. Other? | 1 2 3 4 5 |
| 5. Other? | 1 2 3 4 5 |
| | |
| **G. Graphic Communications Past & Future** | |
| 1. History of Graphic Communications | 1 2 3 4 5 |
| 2. Current Developments and Trends in Graphic Communications | 1 2 3 4 5 |
| 3. Other? | 1 2 3 4 5 |
| 4. Other? | 1 2 3 4 5 |
| | |
| **H. Safety and Health** | |
| 1. Industrial Safety & Health | 1 2 3 4 5 |
| 2. Environment Regulations/Environmental Protection | 1 2 3 4 5 |
| 3. Other? | 1 2 3 4 5 |
| 4. Other? | 1 2 3 4 5 |
| | |
| **I. Fundamental Marketing** | |
| 1. Marketing in Graphic Communications | 1 2 3 4 5 |
| 2. Sales in Graphic Communications | 1 2 3 4 5 |
| 3. Customer Services in Graphic Communications | 1 2 3 4 5 |
| 4. Pricing, Costing, & Estimating Analysis | 1 2 3 4 5 |
| 5. Advertising | 1 2 3 4 5 |
| 6. Fundamental Economics in Graphic Communications | 1 2 3 4 5 |
| 7. E-Commerce/E-Business (e.g. WebPages Business & Service) | 1 2 3 4 5 |
| 8. Other? | 1 2 3 4 5 |
| 9. Other? | 1 2 3 4 5 |
| | |
| **J. Business & Management** | |
| 1. Human Resources Management/Personal Leadership | 1 2 3 4 5 |
| 2. Fundamental Management in Graphic Communications | 1 2 3 4 5 |

| | |
|---|---|
| 3. Fundamental Finance in Graphic Communications | 1 2 3 4 5 |
| 4. Fundamental Accounting in Graphic Communications | 1 2 3 4 5 |
| 5. Organizational Management | 1 2 3 4 5 |
| 6. Business Law | 1 2 3 4 5 |
| 7. Other? | 1 2 3 4 5 |
| 8. Other? | 1 2 3 4 5 |
| | |
| **K. Production Management** | |
| 1. Quality Standards: ISO & ANSI | 1 2 3 4 5 |
| 2. Quality Assurance Management | 1 2 3 4 5 |
| 3. Supervision in the Graphic Communications | 1 2 3 4 5 |
| 4. Printing Scheduling/Workflow | 1 2 3 4 5 |
| 5. Other? | 1 2 3 4 5 |
| 6. Other? | 1 2 3 4 5 |
| | |
| **L. Digital Printing Technology** | |
| 1. Variable Data & Personalized Printing | 1 2 3 4 5 |
| 2. On-Demand Printing | 1 2 3 4 5 |
| 3. Computer-to-Plate & Direct-Imaging Technology | 1 2 3 4 5 |
| 4. Digital & Web Publishing | 1 2 3 4 5 |
| 5. Digital Proofing | 1 2 3 4 5 |
| 6. Other? | 1 2 3 4 5 |
| 7. Other? | 1 2 3 4 5 |
| | |
| **M. Computer** | |
| 1. Database Management System | 1 2 3 4 5 |
| 2. Internet | 1 2 3 4 5 |
| 3. Networking | 1 2 3 4 5 |
| 4. Programming Languages | 1 2 3 4 5 |
| 5. Information Systems/Information Technology | 1 2 3 4 5 |
| 6. Other? | 1 2 3 4 5 |
| 7. Other? | 1 2 3 4 5 |
| | |
| **N. Others** | |
| 1. Ink & Substrates | 1 2 3 4 5 |
| 2. Paper Technology | 1 2 3 4 5 |
| 3. Career Planning | 1 2 3 4 5 |
| 4. Research Methods in Graphic Communication | 1 2 3 4 5 |
| 5. Other? | 1 2 3 4 5 |
| 6. Other? | 1 2 3 4 5 |
| | |
| **O. Other Category?** | |
| 1. Other? | 1 2 3 4 5 |
| 2. Other? | 1 2 3 4 5 |
| 3. Other? | 1 2 3 4 5 |
| | |
| **P. Other Category?** | |
| 1. Other? | 1 2 3 4 5 |
| 2. Other? | 1 2 3 4 5 |
| 3. Other? | 1 2 3 4 5 |
| | |

| Q. Other Category? | |
|---|---|
| 1. Other? | 1 2 3 4 5 |
| 2. Other? | 1 2 3 4 5 |
| 3. Other? | 1 2 3 4 5 |
| | |
| **Please make any additional comments below about the categories and content** | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |
| | |

# APPENDIX C

## THE COVER LETTER FOR THE EXPERT PANEL

Dear Dr.:

I would like to ask for your help in my research. I am a doctoral student focusing on graphic communications in the Department of Industrial Technology at the University of Northern Iowa. This is a curriculum study that is focused on graphic communications undergraduate curriculum.

As an expert in graphic communications and also as recommended by TAGA, your participation in this study would be greatly appreciated. You are one of 5 people selected for an Expert Panel.

Only one round of the questionnaire will be used if there is no wide disagreement between experts. Otherwise, one more questionnaire may be sent. The questionnaire should take no more than 20 minutes for you to complete.

The Expert Questionnaire is attached. I would greatly appreciate a reply within the next 10 days using the self-addressed stamped envelope. If you have questions regarding this study, please write to me at ***tyhao@aol.com*** or call me at (319) 222-5811. After completing the study, the final results will be mailed to you.

Sincerely,

Tsung-Yu Hao
Doctoral candidate
Encl.

This study is being conducted under the direction of Dr. Charles D. Johnson, Professor. Department of Industrial Technology, University of Northern Iowa.
You can reach my advisor at ***charles.johnson@uni.edu*** or (319) 273-2746

# APPENDIX D

## THE COVER LETTER FOR GRAPHIC COMMUNICATIONS FACULTY

Dear Dr. :

I would like to ask for your help in my research. I am a doctoral student focusing on graphic communications in the Department of Industrial Technology at the University of Northern Iowa. This is a curriculum study that is focused on graphic communications undergraduate curriculum.

As an educator in graphic communications, your participation in this study would be greatly important to generate the ideas of the content in GC when developing the GC curriculum. The questionnaire should take no more than 15 minutes for you to complete. I value your thought and opinions on this issue.

The survey questionnaire is attached with this mail. I would greatly appreciate your reply by completing and returning your responses within the next 10 days in the self-addressed stamped envelope. All the responses to the survey questionnaire are completely confidential. The identification number is only for checking off your returned questionnaire.

For your convenience, please visit the web page at ***http://fp.uni.edu/hao48/*******.htm***, which is your personal web page for you to participate in this study. If you have questions regarding this study, please write to me at ***tyhao@aol.com*** or call me at (650) 968-8968. After completing the study, the final results will be mailed to you.

If you would like to receive a summary of the results, please provide the necessary information, your name, address, and e-mail, on the bottom of the questionnaire.

Sincerely,

Tsung-Yu Hao
Doctoral candidate

Enclosures

This study is being conducted under the direction of Dr. Charles D. Johnson, Professor, Department of Industrial Technology, University of Northern Iowa.
You can reach my advisor at ***charles.johnson@uni.edu*** or (319) 273-2746

# APPENDIX E

## THE STEM-AND-LEAF DISPLAYS OF YEARS OF TEACHING EXPERIENCE FOR GRAPHIC COMMUNICATIONS FACULTY

1. Instructor

| Frequency | Stem & Leaf | |
|---|---|---|
| 10 | 0 | 1333445577 |
| 5 | 1 | 00223 |
| 2 | 2 | 00 |
| 3 | 3 | 135 |

Stem width = 10
Each leaf = 1 case

2. Assistant Professor

| Frequency | Stem & Leaf | |
|---|---|---|
| 10 | 0 | 1145566677 |
| 7 | 1 | 0022257 |
| 3 | 2 | 033 |
| 1 | 3 | 0 |

Stem width = 10
Each leaf = 1 case

3. Associate Professor

| Frequency | Stem & Leaf | |
|---|---|---|
| 3 | 0 | 568 |
| 8 | 1 | 01335566 |
| 8 | 2 | 00355788 |
| 2 | 3 | 05 |

Stem width = 10
Each leaf = 1 case

4. Professor

| Frequency | Stem & Leaf | |
|---|---|---|
| 1 | 0 | 2 |
| 7 | 1 | 0145689 |
| 13 | 2 | 0234445555788 |
| 8 | 3 | 01225556 |
| 1 | 4 | 2 |

Stem width = 10
Each leaf = 1 case

5. Total Graphic Communications Faculty

| Frequency | Stem & Leaf | |
|---|---|---|
| 24 | 0 | 111233344455555666677778 |
| 27 | 1 | 000000112222233345555666789 |
| 26 | 2 | 00000023333444555555778888 |
| 14 | 3 | 00011223555556 |
| 1 | 4 | 2 |

Stem width = 10
Each leaf = 1 case

# APPENDIX F

## THE QUESTIONNAIRE FOR GRAPHIC COMMUNICATIONS FACULTY

## Questionnaire for Graphic Communications Curriculum

**Overview**: This questionnaire is concerned with important content for comprehensive undergraduate graphic communications programs. Your opinions will be greatly appreciated.

**Directions**: There are 14 categories in the following list. Please rate the content items regarding your belief on ***how important*** each item is as part of a comprehensive graphic communications a program at the undergraduate level. Each item is rated on a 1 to 5 scale, with 1 being no importance, and 5 being very high importance.

Please make any comments about the categories or content items directly on the form. Also, if you believe other content should be included, please add it and rate each item. There is a section at the end of the questionnaire for any other comments you may wish to make.

**1: No Importance; 2: Low Importance; 3: Moderate Importance; 4: Fairly High Importance; 5: Very High Importance**

## *Subject Categories and Content Items*

| | *(Please circle the appropriate Importance into numbers)* | | | | |
|---|---|---|---|---|---|
| *A. Science & Mathematics* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. General Chemistry | 1 | 2 | 3 | 4 | 5 |
| 2. General Physics | 1 | 2 | 3 | 4 | 5 |
| 3. College Mathematics: Algebra/Trigonometry | 1 | 2 | 3 | 4 | 5 |
| 4. Finite Mathematics | 1 | 2 | 3 | 4 | 5 |
| 5. Calculus | 1 | 2 | 3 | 4 | 5 |
| 6. General Statistics | 1 | 2 | 3 | 4 | 5 |
| *B. Basic Communication Techniques* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Technical Writing | 1 | 2 | 3 | 4 | 5 |
| 2. Oral Communications & Speech | 1 | 2 | 3 | 4 | 5 |
| 3. Interpersonal Communications Skills | 1 | 2 | 3 | 4 | 5 |
| 4. Business & News Writing | 1 | 2 | 3 | 4 | 5 |
| *C. Graphic Design* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Principles of Page Layout & Design | 1 | 2 | 3 | 4 | 5 |
| 2. Illustration & Computer Graphics | 1 | 2 | 3 | 4 | 5 |
| 3. Multi-Media: Presentation & Animation Software | 1 | 2 | 3 | 4 | 5 |
| 4. Design for WWW | 1 | 2 | 3 | 4 | 5 |

| *D. Prepress* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. Preflighting | 1 | 2 | 3 | 4 | 5 |
| 2. Imaging Acquisition & Editing (e.g. Digital Photo) | 1 | 2 | 3 | 4 | 5 |
| 3. Color Reproduction & Separation | 1 | 2 | 3 | 4 | 5 |
| 4. Composition/Imposition | 1 | 2 | 3 | 4 | 5 |
| 5. Film Imaging Technology | 1 | 2 | 3 | 4 | 5 |
| 6. Electronic Prepress (Publishing) System & Desktop Publishing System | 1 | 2 | 3 | 4 | 5 |
| 7. Color Management System | 1 | 2 | 3 | 4 | 5 |

| *E. Press* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. Lithography Process | 1 | 2 | 3 | 4 | 5 |
| 2. Gravure Process | 1 | 2 | 3 | 4 | 5 |
| 3. Flexography Process | 1 | 2 | 3 | 4 | 5 |
| 4. Screen Process | 1 | 2 | 3 | 4 | 5 |
| 5. Electrophotographic/Non-Impact (e.g. Ink Jet) | 1 | 2 | 3 | 4 | 5 |

| *F. Postpress* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. Binding/Finishing Process | 1 | 2 | 3 | 4 | 5 |
| 2. Packaging Process | 1 | 2 | 3 | 4 | 5 |
| 3. Fulfillment | 1 | 2 | 3 | 4 | 5 |
| 4. Distribution/Demographic Finishing | 1 | 2 | 3 | 4 | 5 |

| *G. Graphic Communications Past & Future* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. History of Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 2. Current Developments and Trends in Graphic Communications | 1 | 2 | 3 | 4 | 5 |

| *H. Safety and Health* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. Industrial Safety & Health | 1 | 2 | 3 | 4 | 5 |
| 2. Environment Regulations/Environmental Protection | 1 | 2 | 3 | 4 | 5 |

| *I. Fundamental Marketing* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. Marketing in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 2. Sales in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 3. Customer Services in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 4. Pricing, Costing, & Estimating Analysis | 1 | 2 | 3 | 4 | 5 |
| 5. Advertising | 1 | 2 | 3 | 4 | 5 |
| 6. Fundamental Economics in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 7. E-Commerce/E-Business (e.g. WebPages Business & Service) | 1 | 2 | 3 | 4 | 5 |

| *J. Business & Management* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
|---|---|---|---|---|---|
| 1. Human Resources Management/Personal Leadership | 1 | 2 | 3 | 4 | 5 |
| 2. Fundamental Management in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 3. Fundamental Finance in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 4. Fundamental Accounting in Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 5. Organizational Management | 1 | 2 | 3 | 4 | 5 |
| 6. Business Law | 1 | 2 | 3 | 4 | 5 |
| *K. Production Management* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Quality Standards: ISO & ANSI | 1 | 2 | 3 | 4 | 5 |
| 2. Quality Assurance Management | 1 | 2 | 3 | 4 | 5 |
| 3. Supervision in the Graphic Communications | 1 | 2 | 3 | 4 | 5 |
| 4. Printing Scheduling/Workflow | 1 | 2 | 3 | 4 | 5 |
| *L. Digital Printing Technology* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Variable Data & Personalized Printing | 1 | 2 | 3 | 4 | 5 |
| 2. On-Demand Printing | 1 | 2 | 3 | 4 | 5 |
| 3. Computer-to-Plate & Direct-Imaging Technology | 1 | 2 | 3 | 4 | 5 |
| 4. Digital Proofing | 1 | 2 | 3 | 4 | 5 |
| *M. Computer* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Database Management System | 1 | 2 | 3 | 4 | 5 |
| 2. Internet | 1 | 2 | 3 | 4 | 5 |
| 3. Networking | 1 | 2 | 3 | 4 | 5 |
| 4. Programming Languages | 1 | 2 | 3 | 4 | 5 |
| 5. Information Systems/Information Technology | 1 | 2 | 3 | 4 | 5 |
| *N. Digital Media/Publishing* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Streaming Video | 1 | 2 | 3 | 4 | 5 |
| 2. E-Book | 1 | 2 | 3 | 4 | 5 |
| 3. Cross Media Publishing | 1 | 2 | 3 | 4 | 5 |
| 4. Digital & Web Publishing | 1 | 2 | 3 | 4 | 5 |
| *O. Others* | *No Importance* | *Low Importance* | *Moderate Importance* | *Fairly High Importance* | *Very High Importance* |
| 1. Ink & Substrates | 1 | 2 | 3 | 4 | 5 |
| 2. Paper Technology | 1 | 2 | 3 | 4 | 5 |
| 3. Career Planning | 1 | 2 | 3 | 4 | 5 |
| 4. Research Methods in Graphic Communication | 1 | 2 | 3 | 4 | 5 |

| Please make any additional comments below about the categories and content items |
| --- |
| |
| |
| |
| |
| |
| |
| |

**Demographic Information** *(Check {√} the appropriate response)*

Title: ___ Professor ___ Associate Professor ___ Assistant Professor ___ Instructor

Years of Teaching Experience in Graphic Communications: _____ Years

Gender: _____ Male _____ Female

# APPENDIX G

## THE ABBREVIATIONS FOR CONTENT ITEMS AND SUBJECT CATEGORIES

A. Abbreviations for Content Items:

| | | |
|---|---|---|
| CHM | = | General Chemistry |
| PHY | = | General Physics |
| ALG | = | College Mathematics: Algebra/Trigonometry |
| FMA | = | Finite Mathematics |
| CAL | = | Calculus |
| STA | = | General Statistics |
| TWG | = | Technical Writing |
| OCS | = | Oral Communications & Speech |
| ICS | = | Interpersonal Communications Skills |
| BNW | = | Business & News Writing |
| LDN | = | Principles of Page Layout & Design |
| ILL | = | Illustration & Computer Graphics |
| MUM | = | Presentation & Animation Software |
| DWW | = | Design for the WWW |
| PFT | = | Preflighting |
| IAE | = | Imaging Acquisition & Editing |
| CRS | = | Color Reproduction & Separation |
| COM | = | Composition/Imposition |
| FIM | = | Film Imaging Technology |
| EPS | = | Electronic Prepress (Publishing) System & Desktop Publishing System |
| CMS | = | Color Management System |
| LIT | = | Lithography Process |
| GRA | = | Gravure Process |
| FLX | = | Flexography Process |
| SCR | = | Screen Process |
| EPE | = | Electro-photographic/Non-Impact |
| VDP | = | Variable Data & Personalized Printing |
| ODP | = | On-Demand Printing |
| CTP | = | Computer-to-Plate & Direct-Imaging Technology |
| PRF | = | Digital Proofing |
| BIN | = | Binding/Finishing Process |
| PAK | = | Packaging Process |
| FUL | = | Fulfillment |
| DDF | = | Distribution/Demographic Finishing |
| HIS | = | History of Graphic Communications |
| CDT | = | Current Developments and Trends in Graphic Communications |
| ISY | = | Industrial Safety & Health |
| ERP | = | Environment Regulations/Environmental Protection |
| MKT | = | Marketing in Graphic Communications |
| SGC | = | Sales in Graphic Communications |
| CSG | = | Customer Services in Graphic Communications |
| PCE | = | Pricing, Costing, & Estimating Analysis |

ADV = Advertising
ECO = Fundamental Economics in Graphic Communications
ECB = E-Commerce/E-Business
HRM = Human Resources Management/Personal Leadership
MGN = Fundamental Management in Graphic Communications
FIN = Fundamental Finance in Graphic Communications
ACC = Fundamental Accounting in Graphic Communications
OMT = Organizational Management
LAW = Business Law
ISO = Quality of Standards: ISO & ANSI
QAM = Quality Assurance of Management
SPN = Supervision in the Graphic Communications
WKW = Printing Scheduling/Workflow
STV = Streaming Video
EBK = E-Book
CMP = Cross Media Publishing
WBP = Digital & Web Publishing
DMS = Database Management System
INT = Internet
NET = Networking
PLG = Programming Language
IST = Information Systems/Information Technology
INK = Ink & Substrates
PTY = Paper Technology
CPG = Career Planning
RMC = Research Methods in Graphic Communication

B. Abbreviations for Subject Categories:

SAM = Science & Mathematics
CTE = Basic Communication Techniques
GDN = Graphic Design
PRE = Prepress
PSS = Press
DPT = Digital Printing Technology
POS = Postpress
PAF = Graphic Communications Past & Future
SAH = Safety & Health
FMT = Fundamental Marketing
BAM = Business & Management
PMT = Production Management
DMP = Digital Media Publishing
COP = Computer
OTH = Others

# APPENDIX H

## DESCRTPTIVE STATISTICS OF CONTENT ITEMS AND SUBJECT CATEGORIES FOR EXPERT PANELISTS

A. Mean scores and standard deviations of content items for Expert Panelists (N = 5)

| Subject Category/Content Item | M | SD |
|---|---|---|
| A. Science & Mathematics | | |
| 1. General Chemistry | 3.00 | 1.00 |
| 2. General Physics | 2.80 | 1.30 |
| 3. College Mathematics: Algebra/Trigonometry | 3.60 | .55 |
| 4. Finite Mathematics | 2.60 | .45 |
| 5. Calculus | 2.40 | .55 |
| 6. General Statistics | 4.40 | .55 |
| B. Basic Communication Techniques | | |
| 1. Technical Writing | 4.60 | .55 |
| 2. Oral Communications & Speech | 4.40 | .89 |
| 3. Interpersonal Communications Skills | 4.40 | .89 |
| 4. Business & News Writing | 3.60 | 1.34 |
| C. Graphic Design | | |
| 1. Principles of Page Layout & Design | 4.00 | 1.22 |
| 2. Illustration & Computer Graphics | 4.00 | .71 |
| 3. Presentation & Animation Software | 3.80 | .84 |
| 4. Design for the WWW | 3.80 | .55 |
| D. Prepress | | |
| 1. Preflighting | 4.40 | .55 |
| 2. Imaging Acquisition & Editing | 4.80 | .45 |
| 3. Color Reproduction & Separation | 5.00 | .00 |
| 4. Composition/Imposition | 4.40 | .89 |
| 5. Film Imaging Technology | 4.80 | .45 |
| 6. Electronic Prepress (Publishing) System & Desktop Publishing System | 4.60 | .55 |
| 7. Color Management System | 5.00 | .00 |
| E. Press | | |
| 1. Lithography Process | 5.00 | .00 |
| 2. Gravure Process | 4.40 | .89 |
| 3. Flexography Process | 4.60 | .55 |
| 4. Screen Process | 4.00 | 1.41 |
| 5. Electro-photographic/Non-Impact | 5.00 | .00 |
| F. Digital Printing Technology | | |
| 1. Variable Data & Personalized Printing | 4.40 | .55 |
| 2. On-Demand Printing | 4.60 | .55 |
| 3. Computer-to-Plate & Direct-Imaging Technology | 4.60 | .55 |
| 4. Digital Proofing | 4.80 | .45 |

| Subject Category/Content Item | M | SD |
|---|---|---|
| G. Postpress | | |
| 1. Binding/Finishing Process | 4.80 | .45 |
| 2. Packaging Process | 4.20 | .45 |
| 3. Fulfillment | 3.40 | .55 |
| 4. Distribution/Demographic Finishing | 4.60 | .89 |
| H. Graphic Communications Past & Future | | |
| 1. History of Graphic Communications | 4.40 | .89 |
| 2. Current Developments and Trends in Graphic Communications | 5.00 | .00 |
| I. Safety & Health | | |
| 1. Industrial Safety & Health | 4.60 | .89 |
| 2. Environment Regulations/Environmental Protection | 4.60 | .89 |
| J. Fundamental Marketing | | |
| 1. Marketing in Graphic Communications | 3.80 | .84 |
| 2. Sales in Graphic Communications | 3.60 | 1.14 |
| 3. Customer Services in Graphic Communications | 3.80 | 1.10 |
| 4. Pricing, Costing, & Estimating Analysis | 4.40 | 1.34 |
| 5. Advertising | 3.00 | 1.00 |
| 6. Fundamental Economics in Graphic Communications | 4.00 | 1.00 |
| 7. -Commerce/E-Business | 4.20 | .84 |
| K. Business & Management | | |
| 1. Human Resources Management/Personal Leadership | 4.20 | .84 |
| 2. Fundamental Management in Graphic Communications | 4.20 | 1.30 |
| 3. Fundamental Finance in Graphic Communications | 4.20 | 1.30 |
| 4. Fundamental Accounting in Graphic Communications | 3.80 | 1.30 |
| 5. Organizational Management | 4.20 | .84 |
| 6. Business Law | 3.40 | 1.14 |
| L. Production Management | | |
| 1. Quality of Standards: ISO & ANSI | 4.00 | .71 |
| 2. Quality Assurance of Management | 4.40 | .89 |
| 3. Supervision in the Graphic Communications | 4.20 | .84 |
| 4. Printing Scheduling/Workflow | 4.40 | 1.34 |
| M. Digital Media Publishing | | |
| 1. Streaming Video | 4.20 | .84 |
| 2. E-Book | 4.00 | 1.15 |
| 3. Cross Media Publishing | 4.40 | .58 |
| 4. Digital & Web Publishing | 4.60 | .55 |

| Subject Category/Content Item | M | SD |
|---|---|---|
| N. Computer | | |
| 1. Database Management System | 3.80 | .84 |
| 2. Internet | 4.40 | .89 |
| 3. Networking | 4.20 | 1.10 |
| 4. Programming Language | 2.60 | 1.52 |
| 5. Information Systems/Information Technology | 3.00 | 1.55 |
| O. Others | | |
| 1. Ink & Substrates | 4.60 | .55 |
| 2. Paper Technology | 4.40 | .55 |
| 3. Career Planning | 3.40 | 1.14 |
| 4. Research Methods in Graphic Communication | 3.40 | .55 |

B. Mean scores and standard deviations of subject categories for Expert Panelists (N = 5)

| Subject Categories | M | SD |
|---|---|---|
| A. Science & Mathematics | 3.23 | .28 |
| B. Basic Communication Techniques | 4.25 | .87 |
| C. Graphic Design | 4.01 | .77 |
| D. Prepress | 4.78 | .29 |
| E. Press | 4.60 | .57 |
| F. Digital Printing Technology | 4.60 | .45 |
| G. Postpress | 4.20 | .45 |
| H. Graphic Communications Past & Future | 4.70 | .45 |
| I. Safety & Health | 4.60 | .89 |
| J. Fundamental Marketing | 3.83 | .88 |
| K. Business & Management | 4.00 | 1.02 |
| L. Production Management | 4.25 | .88 |
| M. Digital Media Publishing | 4.30 | .67 |
| N. Computer | 3.60 | .98 |
| O. Others | 4.00 | .60 |

# APPENDIX I

## MEAN SCORES AND STANDARD DEVIATIONS OF CONTENT ITEMS FOR GRAPHIC COMMUNICATIONS FACULTY

| Subject Category/Content Item | M | SD | N |
|---|---|---|---|
| A. Science & Mathematics | | | |
| 1. General Chemistry | 3.55 | .98 | 99 |
| 2. General Physics | 3.30 | 1.03 | 98 |
| 3. College Mathematics: Algebra/Trigonometry | 3.88 | .88 | 97 |
| 4. Finite Mathematics | 2.82 | 1.03 | 94 |
| 5. Calculus | 2.56 | .96 | 95 |
| 6. General Statistics | 3.71 | 1.01 | 97 |
| B. Basic Communication Techniques | | | |
| 1. Technical Writing | 4.40 | .77 | 99 |
| 2. Oral Communications & Speech | 4.68 | .51 | 99 |
| 3. Interpersonal Communications Skills | 4.75 | .48 | 99 |
| 4. Business & News Writing | 3.81 | .89 | 99 |
| C. Graphic Design | | | |
| 1. Principles of Page Layout & Design | 4.57 | .68 | 99 |
| 2. Illustration & Computer Graphics | 4.39 | .78 | 99 |
| 3. Presentation & Animation Software | 3.94 | .89 | 99 |
| 4. Design for the WWW | 3.93 | .88 | 99 |
| D. Prepress | | | |
| 1. Preflighting | 4.54 | .63 | 98 |
| 2. Imaging Acquisition & Editing | 4.53 | .60 | 99 |
| 3. Color Reproduction & Separation | 4.68 | .55 | 99 |
| 4. Composition/Imposition | 4.58 | .58 | 98 |
| 5. Film Imaging Technology | 4.22 | .85 | 99 |
| 6. Electronic Prepress (Publishing) System & Desktop Publishing System | 4.68 | .54 | 99 |
| 7. Color Management System | 4.54 | .58 | 99 |
| E. Press | | | |
| 1. Lithography Process | 4.65 | .60 | 98 |
| 2. Gravure Process | 4.01 | .86 | 98 |
| 3. Flexography Process | 4.29 | .77 | 98 |
| 4. Screen Process | 3.82 | .98 | 98 |
| 5. Electro-photographic/Non-Impact | 4.13 | .85 | 99 |
| F. Digital Printing Technology | | | |
| 1. Variable Data & Personalized Printing | 4.17 | .78 | 99 |
| 2. On-Demand Printing | 4.21 | .78 | 98 |
| 3. Computer-to-Plate & Direct-Imaging Technology | 4.43 | .68 | 99 |
| 4. Digital Proofing | 4.55 | .61 | 99 |

| Subject Category/Content Item | M | SD | N |
|---|---|---|---|
| G. Postpress | | | |
| 1. Binding/Finishing Process | 4.39 | .77 | 99 |
| 2. Packaging Process | 3.99 | .83 | 99 |
| 3. Fulfillment | 3.64 | .94 | 98 |
| 4. Distribution/Demographic Finishing | 3.70 | .90 | 99 |
| H. Graphic Communications Past & Future | | | |
| 1. History of Graphic Communications | 3.75 | .82 | 98 |
| 2. Current Developments and Trends in Graphic Communications | 4.64 | .63 | 98 |
| I. Safety & Health | | | |
| 1. Industrial Safety & Health | 4.36 | .75 | 99 |
| 2. Environment Regulations/Environmental Protection | 4.33 | .80 | 99 |
| J. Fundamental Marketing | | | |
| 1. Marketing in Graphic Communications | 4.05 | .78 | 99 |
| 2. Sales in Graphic Communications | 4.00 | .76 | 98 |
| 3. Customer Services in Graphic Communications | 4.29 | .78 | 99 |
| 4. Pricing, Costing, & Estimating Analysis | 4.36 | .74 | 99 |
| 5. Advertising | 3.44 | .88 | 98 |
| 6. Fundamental Economics in Graphic Communications | 3.87 | .80 | 99 |
| 7. -Commerce/E-Business | 3.86 | .81 | 99 |
| K. Business & Management | | | |
| 1. Human Resources Management/Personal Leadership | 4.10 | .81 | 98 |
| 2. Fundamental Management in Graphic Communications | 4.29 | .79 | 98 |
| 3. Fundamental Finance in Graphic Communications | 3.90 | .85 | 98 |
| 4. Fundamental Accounting in Graphic Communications | 3.82 | .90 | 97 |
| 5. Organizational Management | 4.10 | .79 | 97 |
| 6. Business Law | 3.58 | .90 | 97 |
| L. Production Management | | | |
| 1. Quality of Standards: ISO & ANSI | 4.08 | .79 | 99 |
| 2. Quality Assurance of Management | 4.24 | .79 | 99 |
| 3. Supervision in the Graphic Communications | 4.30 | .86 | 99 |
| 4. Printing Scheduling/Workflow | 4.38 | .70 | 99 |
| M. Digital Media Publishing | | | |
| 1. Streaming Video | 3.23 | .86 | 97 |
| 2. E-Book | 3.39 | .89 | 97 |
| 3. Cross Media Publishing | 4.02 | .89 | 98 |
| 4. Digital & Web Publishing | 4.01 | .84 | 97 |

| Subject Category/Content Item | M | SD | N |
|---|---|---|---|
| N. Computer | | | |
| 1. Database Management System | 3.97 | .82 | 99 |
| 2. Internet | 4.17 | .78 | 99 |
| 3. Networking | 3.91 | .83 | 98 |
| 4. Programming Language | 2.72 | .96 | 99 |
| 5. Information Systems/Information Technology | 3.48 | .90 | 98 |
| O. Others | | | |
| 1. Ink & Substrates | 4.43 | .76 | 99 |
| 2. Paper Technology | 4.40 | .79 | 99 |
| 3. Career Planning | 4.10 | .86 | 99 |
| 4. Research Methods in Graphic Communication | 3.85 | .91 | 98 |

# APPENDIX J

## MEAN SCORES OF SUBJECT CATEGORIES

## FOR GRAPHIC COMMUNICATIONS FACULTY

| Subject Categories | M | SD | N |
|---|---|---|---|
| A. Science & Mathematics | 3.31 | .71 | 94 |
| B. Basic Communication Techniques | 4.41 | .49 | 99 |
| C. Graphic Design | 4.21 | .67 | 99 |
| D. Prepress | 4.53 | .46 | 98 |
| E. Press | 4.15 | .62 | 98 |
| F. Digital Printing Technology | 4.33 | .59 | 98 |
| G. Postpress | 3.93 | .71 | 98 |
| H. Graphic Communications Past & Future | 4.15 | .62 | 98 |
| I. Safety & Health | 4.30 | .77 | 99 |
| J. Fundamental Marketing | 3.99 | .62 | 98 |
| K. Business & Management | 3.90 | .69 | 97 |
| L. Production Management | 4.25 | .66 | 99 |
| M. Digital Media Publishing | 3.60 | .78 | 97 |
| N. Computer | 3.68 | .63 | 98 |
| O. Others | 4.20 | .66 | 98 |

# APPENDIX K

## CORRELATION MATRIX OF CONTENT ITEMS IN EACH SUBJECT CATEGORY

1. Subject Category A: Science and Mathematics (SAM)

| | CHM | PHY | ALG | FMA | CAL |
|---|---|---|---|---|---|
| 2. PHY | .70 | | | | |
| 3. ALG | .39 | .45 | | | |
| 4. FMA | .34 | .38 | .38 | | |
| 5. CAL | .33 | .39 | .42 | .51 | |
| 6. STA | .44 | .37 | .31 | .28 | .29 |

2. Subject Category B: Basic Communication Techniques (CTE)

| | TWG | OCS | ICS |
|---|---|---|---|
| 2. OCS | .54 | | |
| 3. ICS | .29 | .68 | |
| 4. BNW | .25 | .28 | .23 |

3. Subject Category C: Graphic Design (GDN)

| | LDN | ILL | MUM |
|---|---|---|---|
| 2. ILL | .67 | | |
| 3. MUM | .49 | .56 | |
| 4. DWW | .43 | .59 | .63 |

4. Subject Category D: Prepress (PRE)

| | PFT | IAE | CRS | COM | FIM | EPS |
|---|---|---|---|---|---|---|
| 2. IAE | .60 | | | | | |
| 3. CRS | .56 | .64 | | | | |
| 4. COM | .55 | .64 | .77 | | | |
| 5. FIM | .36 | .34 | .46 | .48 | | |
| 6. EPS | .57 | .66 | .75 | .66 | .48 | |
| 7. CMS | .56 | .52 | .58 | .53 | .30 | .67 |

5. Subject Category E: Press (PSS)

| | LIT | GRA | FLX | SCR |
|---|---|---|---|---|
| 2. GRA | .40 | | | |
| 3. FLX | .56 | .69 | | |
| 4. SCR | .32 | .62 | .57 | |
| 5. EPE | .21 | .36 | .42 | .44 |

6. Subject Category F: Digital Printing Technology (DPT)

| | VDP | ODP | CTP |
|---|---|---|---|
| 2. ODP | .81 | | |
| 3. CTP | .53 | .61 | |
| 4. PRF | .50 | .58 | .72 |

7. Subject Category G: Postpress (POS)

| | BIN | PAK | FUL |
|---|---|---|---|
| 2. PAK | .50 | | |
| 3. FUL | .46 | .64 | |
| 4. DDF | .34 | .57 | .79 |

8. Subject Category H: Graphic Communications Past and Future (PAF)

| | HIS |
|---|---|
| 2: CDT | .45 |

9. Subject Category I: Safety and Health (SAH)

| | ISY |
|---|---|
| 2: ERP | .82 |

10. Subject Category J: Fundamental Marketing (FMT)

| | MKT | SGC | CSG | PCE | ADV | ECO |
|---|---|---|---|---|---|---|
| 2: SGC | .82 | | | | | |
| 3: CSG | .66 | .67 | | | | |
| 4: PCE | .45 | .49 | .58 | | | |
| 5: ADV | .56 | .64 | .40 | .29 | | |
| 6: ECO | .43 | .51 | .46 | .41 | .46 | |
| 7: ECB | .61 | .56 | .32 | .33 | .60 | .44 |

11. Subject Category K: Business and Management (BAM)

| | HRM | MGN | FIN | ACC | OMT |
|---|---|---|---|---|---|
| 2: MGN | .64 | | | | |
| 3: FIN | .66 | .65 | | | |
| 4: ACC | .64 | .56 | .84 | | |
| 5: OMT | .53 | .65 | .56 | .59 | |
| 6: LAW | .43 | .42 | .56 | .56 | .41 |

12. Subject Category L: Production Management (PMT)

| | ISO | QAM | SPN |
|---|---|---|---|
| 2: QAM | .67 | | |
| 3: SPN | .57 | .62 | |
| 4: WKW | .52 | .59 | .65 |

13. Subject Category M: Digital Media/Publishing (DMP)

| | STV | EBK | CMP |
|---|---|---|---|
| 2: EBK | .73 | | |
| 3: CMP | .48 | .62 | |
| 4: WBP | .44 | .53 | .77 |

14. Subject Category N: Computer (COP)

| | DMS | INT | NET | PLG |
|---|---|---|---|---|
| 2: INT | .32 | | | |
| 3: NET | .46 | .48 | | |
| 4: PLG | .39 | .22 | .44 | |
| 5: IST | .45 | .23 | .41 | .54 |