Journal of
INDUSTRIAL
TECHNOLOGY

Volume 21, Number 3 - July 2005 through September 2005

Telecommunication Systems Program Evaluation: A Survey of TCS Alumni on the Curriculum

By Dr. H. Naik Dharavath and Dr. Steve Schlough

Non-Refereed Article

KEYWORD SEARCH

Assessment
Administration
Curriculum
Higher Education

Telecommunication Systems Program Evaluation: A Survey of TCS Alumni on the Curriculum

By Dr. H. Naik Dharavath and Dr. Steve Schlough

Dr. H. Naik Dharavath is an Associate Professor of Graphic Communications Management at the University of Wisconsin-Stout. He received a Bachelor of Science in Graphic Communications Technology from Rochester Institute of Technology (1995), a Master of Technology in Graphic Communications from Arizona State University (1998), and a Ph.D. in Applied Science and Technology Education from University of Wyoming (2002).

He teaches Graphic Communications/Electronic Publishing and Postpress/Distribution Operations Management courses. In addition to teaching, he advises UW-Stout TAGA Student Chapter. In 2004, UW-Stout TAGA Chapter received FIRST PLACE AWARD for overall quality of Non-Print Edition of the Student Journal. His research interest in Graphic Communications Technology includes Print Manufacturing Management, Curriculum Development, Educational Program Evaluation and Assessment, and Print Quality Management (Color Management, TQM/SPC, and Colorimetric Analysis).

Dr. Dharavath has received an "Educational Grant" award from Gravure Educational Foundation, in 1999. In addition, he has also received GATF/PGSF Graduate Fellowship award for 4 academic years (1997 - 2001).

Dr. Steve Schlough is an associate professor of Telecommunications and the Chair of the Communications, Education, and Training Department and program director for the BS in Telecommunications System in the College of Technology, Engineering & Management at the University of Wisconsin-Stout. He has been at UW-Stout since 1988, teaching a variety of undergraduate and graduate courses in telecommunications, career technical education, instructional technology, communications technology, and computer technology. Prior to joining UW-Stout, Steve held a variety of sales, marketing and management positions in the agricultural equipment industry. He earned his BS in Business Administration in 1975 and a MS in media technology in 1987, both from UW-Stout, and completed his PhD in Computing Technology from the Nova Southeastern University in 1996.

Abstract

In the United States, telecommunications has evolved into a major industry and has become more efficient through new technologies. Its content is constantly changing due to rapid advancements and trends that are taking place in the information and communications technology sectors of the industry. The purpose of this research was to determine the perceptions of the University of Wisconsin-Stout (UW-Stout) telecommunication systems (TCS) alumni on the quality of the TCS curriculum. The scope of the research was limited to the TCS program at UW-Stout, and the findings were not expected to be generalizable to other populations. This research utilized a descriptive research method. The target population for this study consists of available UW-Stout TCS alumni who graduated from 1998 to 2003. The major findings of the study show that the Telecommunications program is in need of revision. This study validates that the Telecommunication Systems program at the University of Wisconsin-Stout is a program in need of improvement. The results of this study, combined with information obtained from advisory committee members, will guide telecommunications faculty to make course and program revisions that will continue to enhance/improve the program.

Keywords

Alumni feedback, curriculum, program development, telecommunications, information systems, educational preparation.

Introduction

The invention of the telephone by Alexander Graham Bell in 1876 did a great deal to foster communication (Senn, 2004). Today, communication technology is a generic label that utilizes several techniques for sending and receiving voice, data and information over a communications network. These techniques are also known as telecommunication systems, information technology or information technology systems. A communications network consists of set stations at different locations that enable people to communicate (voice), send and receive data or information (Senn, 2004). The field of telecommunication systems (TCS) has had its place in the history of the University of Wisconsin-Stout (UW-Stout). The university has been offering a Telecommunication Systems Bachelor of Science degree since 1995. Previously, the university offered a Telecommunications concentration under its Industrial Technology degree. The Telecommunication Systems (TCS) program is one of the largest in the Midwest, preparing graduates for productive careers in the telecommunications and associated industries.

The United States Department of Labor (DOL) stated that the telecommunications industry offers a host of career opportunities including management, sales, technical, customer service and more (DOL, 2004). Telecommunications graduates from a technical or community college qualify for an entry-level or a technician position in industry. Similarly, graduates of a four-year or university-level telecommunications program qualify for entry-level supervisory management-trainee or middle-

management positions (DOL, 2004). Telecommunications is an exciting and rapidly changing industry. Dynamic is a word that defines today's telecommunications industry. Information technology is expanding and growing rapidly. An integral part of information technology is communications – the sending and receiving of information over a communication network (Senn, 2004).
The University of Wisconsin-Stout's TCS program prepares its students to be managers who are leaders, motivators and information and communication technologists, and who can deal with business issues ranging from policy information to production efficiency. To accomplish this, the program includes course work in general and professional education, as well as focused technical courses in the program. The TCS program emphasizes written and oral communications, data, voice, media and information and communication technology applications. The technical component of the curriculum focuses on contemporary methods of analysis, design and telecommunication systems solutions. Technical courses are delivered in areas including telephony, networking, telecommunication policy and regulation, administration, video, imaging and multimedia applications.

TSC students are also required to complete required courses in the areas of business, management, general education and science. Students completing the TCS program will also earn highly respected certificates: Cisco Certified Network Associate (CCNA), Cisco Certified Design Associate (CCDA), Cisco Certified Network Professional (CCNP) and Cisco Certified Design Professional (CCDP). UW-Stout's "hands-on, minds-on" approach to learning is integrated into the TCS curriculum by delivering quality instruction through a blend of theory, experimentation and practice. Additionally, this approach allows students to gain work experience before graduation by completing an on-campus practicum or off-campus field experience or internship.

For many decades telecommunication systems was offered as a concentration in the Industrial Technology Bachelor of Science degree at UW-Stout. In 1995, when it was approved as a separate Bachelor of Science degree program, a major curriculum revision was completed. While periodic course revisions have taken place in the interim, no significant changes have been made to the program since 1995. In the spirit of UW-Stout's commitment to continuous improvement, the program is currently undertaking a comprehensive curriculum review and possible revision. The fact that a growing pool of graduates of the existing program are now working in the industry and could be surveyed for their feedback made this research both feasible and meaningful. It was also important to evaluate the major, its graduates, and employers of graduates, as the number of students in the major had been decreasing over the past several years.

Purpose of the Research

The purpose of this research was to determine the perceptions of the University of Wisconsin-Stout (UW-Stout) telecommunication systems (TCS) alumni on the quality of the TCS curriculum. The results will be analyzed and used in the planning for a revision of the curriculum. The following questions were investigated.

1. How satisfied were alumni with the TCS program?
2. How important were courses from the different components of the curriculum (technical, professional and general education)?
3. How effective was the sequencing of courses in the program?

Limitations of the Study

The scope of the research was limited to the TCS program at UW-Stout, and the findings were not expected to be generalizable to other populations. The research methodology, instrument design, and statistical analysis were all selected in alignment with the purpose of the research with full awareness of the aforementioned delimitations. It is quite likely, however, that similar institutions or programs could be expected to find this study meaningful and useful.

Review of Literature

In preparing research associated with the contents of this study, current literature concerning the telecommunications industry (TCI), information and communications technology (ICT) curriculum, and perceptions of alumni of higher educational institutes were reviewed. From this literature, information found to be pertinent to this study was extracted and is presented in the following paragraphs.

In the United States, telecommunications has evolved into a major industry and has become more efficient through new technologies. Its content is constantly changing due to rapid advancements and trends that are taking place in the information and communications technology sectors of the industry. The Telecommunications Industry Association (TIA) reports that, in 2003, the United States telecommunications industry market as a whole totaled $721 billion (TIA, 2004), and the market is expected to grow at a projected 9.2 percent compound annual rate from 2004-07, reaching $1 trillion in 2007 (TIA, 2004). The United States Department of Labor reported that, in 2000, the telecommunications industry (TCI) employed almost 1.2 million wage and salary employees and the employment in the TCI is expected to increase 12 percent over the 2000-10 period, somewhat less than 15 percent projected for all industries combined (DOL, 2004). Employment growth will differ among the various occupations in the TCI, as a result of technological changes in the areas of information and communications technologies.

Gupta & Houtz (2000) stated that many countries in the world are facing a severe shortage of information technology professionals, including the United States (US). Based on data supplied by the Bureau of Labor Statistics (BLS), the office of Technology Policy concluded that the US alone would create nearly 138,000 new information and communication technology (ICT) related jobs per year through 2006 (U.S. Department of Commerce, 1998). According to Price, Reichgelt, and Zhang (2002), despite the economic downturn, managers hiring ICT professionals

expect that of the roughly 1.15 million positions for ICT workers projected for 2002, over 575,000 will remain unfilled. Unfortunately, evidence shows that the nation's educational institutions are unable to meet the growing needs of the business community for outstanding technical and ICT professionals' (Gupta & Houtz, 2000).

In the past ten years, computer technologies have transformed many aspects of everyday life, and in recent years, this transformation has been accelerated and exaggerated by the convergence of information and communications technologies (Oliver & Towers, 2003). Lim (1999, p.144) has stated that the technology that will have the greatest impact in the way information societies function in the future will undoubtedly be network technology as represented by the internet. The universal attribute of modern information society is the influential role of information technology in improving the speed and accuracy of information processing as well as in transforming the every nature of communications, drastically changing the ways that we manage our social organizations and economic activities (Lim, 1999).

In an emerging global economy, rapid advancements in the telecommunications, information and communications technologies (ICT), and the requirements of multi-faceted skills are only some of the challenges facing business today (Mohamed & Lashine, 2003). New technology is often difficult for many older industry workers to adopt, especially with the rapid changes that have occurred over the past ten years in the industry. These rapid changes meant that the environments for which graduates are prepared have changed. Therefore, graduates have to constantly improve their current skills and acquire new ones (Mohamed & Lashine, 2003).

Based on the chronic and severe shortage of skilled information and communication technology professionals, many regional and national governments have made the provision of information technology services an important element in their economic development strategies (Price, et al. 2002). To offset this shortage, many educational programs have revisited their information technology curriculums. For example, in spring 2000, the Georgia Southern University (GSU) started a new School of Information Technology and started its first classes in fall 2001 (Price, et al. 2002). In order to design the curriculum, GSU used extensive consultation with information technology industry representatives. Similarly, the state of Nebraska, like many other states in the country, has invested, and continues to invest, in information technology assets, including hardware, software, telecommunications, training and education (Gupta & Houtz, 2000).

In recent years, because of a national concern over the content of the curriculum and quality of education that post-secondary educational institution students are receiving, there has been a greater demand in performance assessment of educational programs in order to determine the quality of the education being provided (Zargari & Hayes, 1999). Marshall (2000) stated that two common goals of technology-based educational programs across the country are to increase enrollments and to offer a curriculum that is both current and relevant. Zargari & Hayes (1999) stated that the alumni survey can be used as an effective tool for soliciting opinions from graduates about the quality of the completed program curriculum contents.

McGourty (1999) stated that alumni surveys are becoming a popular method for soliciting feedback about the quality of their academic programs. He also stated that the alumni surveys measure self-reported perception, recollections and attitudes of alumni who have graduated from an academic program (McGourty, 1999). Additionally, industry input is also needed to make sound curricular decisions for technology-based educational programs to meet employers' expectations and to increase graduates' technical competency (Wilson, 2001).

Many factors influence a graduate's success in the workplace. Some of the primary factors, however, are the nature and content of the education the student receives, as well as the various educational and industrial experiences encountered by the students over the course of his or her education. In the past ten years, many technology-based programs across the country have been forced to revise their curriculum due to technological changes (Faiola, 1997). This reconsideration includes alumni perception and industry input about the nature and content of the curriculum. Mosley (2001) stated that nearly 70% of technology-based companies cite a lack of skills for workers as a barrier to growth. Technical institutions, community colleges and post-secondary institutions are expected to train and educate students for careers in technical areas (Mosley, 2001).

The perceptions of alumni and industry about the content of the curriculum can be utilized in the planning for a revision of the curriculum. Modern education can prepare an individual to cope with industry advancements (Faiola, 1999). Graduates with modern information and communications technology education and skills are, and will be, in greater demand than ever before in one of the largest industries in the United States. Closing the assessment loop with input from graduates and industry is one method of program validation.

Research Method

This research utilized a descriptive research method. The target population for this study consists of available UW-Stout TCS alumni who graduated from 1998 to 2003. The UW-Stout Alumni office provided a total of 127 current addresses of TCS alumni. Based on the number of available alumni, it was determined that all alumni should be surveyed. In order to elicit information for this study, a four-page survey questionnaire was developed to obtain the perceptions of the target population on the importance of the TCS curriculum. The UW-Stout TCS faculty and the TCS program director reviewed the instrument and it was piloted with TCS juniors and seniors during the spring semester of 2004. Subsequently, 127 survey questionnaires were mailed to TCS alumni. Follow-up surveys were mailed to non-respondents four weeks

after the first mailing. No further follow-up in the form of mailing surveys or telephone was conducted. A five-part Likert-type scale was used throughout the survey questionnaire.

Data Analysis and Research Findings

Of the 127 survey questionnaires that were mailed to TCS alumni, a total of 47 were returned. This represents a 37% return rate. Although this response rate is somewhat low, it provides a 95% certainty that the responses are within +/-10% variance (Bennekom, 2002). Data was generated from the returned surveys. Descriptive statistical methods were used to analyze the data. Analyzed results are presented in the following section.

Program Satisfaction

The mean scores (maximum 5) and the standard deviations associated with the eight statements about the program satisfaction are compiled in Table 1. Of the eight statements, seven statements received mean scores ranging from 2.69 to 3.27. This indicates that alumni were unsatisfied with the teaching they received, the required cooperative work experience, and the overall quality of the program. The remaining statement received a mean score close to the "very satisfied" rating of 4.00. This indicates that the TCS alumni are very satisfied with the TCS program facilities and equipment (see Table 1).

Importance of Curriculum Components

This section presents the perceptions of alumni on the degree of importance of courses required by the program in different curriculum components (technical, professional/ management, and general education). The mean scores and standard deviations of technical component courses are compiled in Table 2. Of the twenty-one courses, fourteen courses received mean scores ranging from 3.75 to 4.33. This indicates that the courses were perceived to be very important and extremely important. Seven courses received mean scores ranging from 2.50 to 3.49, meaning that those courses were perceived to be either moderately important or of little importance. The courses rated below a mean value of 3.00 were elective electrical or electronic engineering courses, taken by only a small percentage of TCS students (see Table 2).

The mean scores and standard deviations regarding the importance of courses in the professional and management component of the program are compiled in Table 3. Of the fourteen courses in the professional/manage-

Table 1. Satisfaction with the Program

Items	M	SD
How well did the program prepare you for employment	2.93	0.99
How well did the program promote your intellectual development	3.27	0.91
Satisfaction with overall program quality	3.20	0.94
Satisfaction with advising	2.84	1.19
Satisfaction with teaching	2.87	0.99
Satisfaction with lab activities/assignments	2.98	1.32
Satisfaction with facilities and technology/equipment	3.73	1.05
Satisfaction with cooperative work experience	2.69	1.43

5 = Extremely Satisfied, 4 = Very Satisfied, 3 = Moderately Satisfied, 2 = Unsatisfied, 1 = Very Unsatisfied

Table 2. Technical Component Courses

Courses	M	SD
TCS-131 NOS Fundamentals	3.96	0.87
TCS-141 Networking Fundamentals I	4.25	0.98
TCS-142 Networking Fundamentals II	4.21	1.05
TCS-143 Networking Fundamentals III	4.18	1.06
TCS-144 Networking Fundamentals IV	4.26	0.98
TCS-206 Introduction to Telephony	3.20	1.22
TCS-281 Data Communications	3.75	0.94
TCS-283 Protocols & Interfacing	3.79	1.04
TCS-381 Data, Voice, & Video	3.70	1.07
TCS-382 Network System Design	4.12	0.90
TCS-441 Scalable Internetworks	4.03	0.89
TCS-442 Remote Access Networks	4.04	0.90
TCS-443 Multi-Layer Switched Networks	4.21	0.93
TCS-444 Internetwork Troubleshooting	4.33	0.76
TCS-445 Internetwork Design	4.30	0.93
TCS-491 Wireless Systems	3.49	1.21
CS-144 Computer Science I	3.11	1.34
ELEC-260 Electrical Circuits	2.74	1.25
ELEC-271 Digital Logic & Switching	2.86	1.12
ELEC-274 Fund. of Microp. & Microc. Systems	2.50	1.29
ELEC-382 Electronic Communications Fund.	2.66	1.16

5 = Extremely Important, 4 = Very Important, 3 = Moderately Important, 2 = Little Important, 1 = Not Important

ment component, five courses received mean scores ranging from 3.72 to 4.24. Respondents recognized INMGT-400 Organizational Leadership, BUMGT-304 Principles of Management and TCS-449 Telecommunications Co-op as being very important. Nine courses received a mean value ranging from 2.55 to 3.39. The rating below 3.00 was received by RC-381 Occupational Safety/Loss Control and STAT-320 Statistical Methods, indicating that respondents perceived it to be less than moderately important. This may be due to the very low number of alumni that took these two courses, because these courses are offered as professional electives only (see Table 3).

The mean scores and standard deviations regarding the importance of courses in the general education and science component are compiled in Table 4. Of the nine courses in this program component, one received a mean score of 4.02. Respondents indicated SPCOM-100 Fundamentals of Speech was a very important course. Eight courses received mean scores ranging from 3.11 to 3.66, indicating that respondents perceived it to be moderately important. The low rating and extremely large standard deviation of responses to ENGL-111 Honors English I may be due to the very low number of alumni that took the class. It is also noteworthy that none of the courses in this component rated below 3.00 (see Table 4).

Course Sequencing

The mean scores and standard deviations of responses to the question on the effectiveness of course sequencing are shown in Table 5. Alumni of the program perceived the sequencing of all component courses was moderately effective (see Table 5).

Free Responses

In addition to the survey items that gathered interval data, the respondents were also asked to provide free responses to some items. The respondents were asked for suggestions of curriculum topics in both the telecommunication systems area as well as the professional business/management area (see Table 6). Though all of those responses

Table 3. Professional/Management Component Courses

Courses	M	SD
TCS-401 Telecom Policy & Regulations	3.04	1.17
TCS-449 Telecommunications Co-op	4.24	1.14
TCS-481 Telecommunications Administration	3.27	0.88
INMGT-120 Quality Concepts	3.09	1.08
INMGT-300 Engineering Economics	3.07	1.27
INMGT-400 Organizational Leadership	4.18	0.98
BUACT-206 Intro. To Financial Accounting	3.20	1.23
BUACT-207 Intro. To Corp. & Mangl. Accounting	3.39	1.25
BUMGT-304 Principles of Management	4.00	0.94
BUMIS-333 MIS Decision Support Systems	3.72	1.07
ENGL-415 Technical Writing	3.93	1.24
RC-381 Occupational Safety/Loss Control	2.74	1.16
STAT-320 Statistical Methods	2.55	1.06
TRHRD-360 Training Systems in Bus. & Industry	3.31	1.14

5 = Extremely Important, 4 = Very Important, 3 = Moderately Important,
2 = Little Important, 1 = Not Important

Table 4. General Education and Science Components Courses

Courses	M	SD
ENGL-101 English Composition	3.66	0.94
ENGL-111 Honors English I	3.11	1.32
ENGL-102 English Reading & Writing	3.31	1.12
ENGL-112 Honors English II	3.31	1.35
SPCOM-100 Fundamentals of Speech	4.02	0.89
PHYS-231 General Physics I	3.50	1.05
PHYS-231 General Physics II	3.41	1.02
MATH-153 Calculus I	3.23	1.11
ECON-210 Principles of Economics	3.32	1.13

5 = Extremely Important, 4 = Very Important, 3 = Moderately Important,
2 = Little Important, 1 = Not Important

Table 5. Course Sequencing

Sequencing	M	SD
Telecommunication Systems Courses	3.43	1.19
Management/Professional Courses	3.64	0.82
General Education Courses	3.57	0.91

5 = Extremely Effective, 4 = Very Effective, 3 = Moderately Effective,
2 = Ineffective, 1 = Very Ineffective

are not included in the table below, they all will be reviewed by the TCS faculty to see if topics could be added to existing courses as they are revised, or whether complete course additions to the curriculum should be considered.

Conclusions

The conclusions of this study are based upon an analysis of the data and major findings. The major findings of the study show that the Telecommunications program is in need of revision. The mean scores were lower than could be expected based on mean scores for a previous study conducted at UW-Stout for the Graphics Communications Management Program (Bensen & Dharavath, 2004). The only required courses scoring below a 3.00 in importance were the electronics courses. The electronics portion of the program was discussed at the April 16, 2004 Telecommunication Systems Program Advisory Committee Meeting and a proposed program change includes lowering the number of electronics courses in the program from four to two (http://cet.uwstout.edu/schloughs/telecom/minutes.html, August 18, 2004). The other two courses, RC-381 and STAT-320, received a mean score lower than 3.00 and are professional elective courses.

The statistical analysis and open-ended comments of this study validate the discussions held at the April 16, 2004 advisory committee meeting for revisions in the program and for considering a program name that is more reflective of the program, such as Information Technology Management.

This study validates that the Telecommunication Systems program at the University of Wisconsin-Stout is a program in need of improvement. The results of this study, combined with information obtained from advisory committee members, will guide telecommunications faculty to make course and program revisions that will continue to enhance/improve the program. Even though the study could have a stronger response rate, it did reinforce the belief of university administration, members of the faculty and the advisory committee that changes were needed in the program. Based on the data and other input, program revisions and a name change will be in place by the Fall of 2005.

Table 6. Free Responses of TCS Alumni

TCS Program Strengths

- Technical and Managed Courses
- Laboratories
- Broad Spectrum of Telecommunication Systems
- CISCO Certification
- Hands-on learning and technology
- Very specific of learning of certain technologies

TCS Program Weaknesses

- Ability of instructors to teach and demonstrate
- Not able to find employment
- Lack of follow-up on stated program direction
- Lack of internship opportunities
- Lack of course and content structure
- Existing laboratory facilities are not incorporated into the learning process

TCS Program Improvements

- Add more emphasis on Telecommunications Engineering and Management
- Add more emphasis on required courses in Computer Science and Information Technology
- Assist students in finding internships and full-time employment
- Make mandatory requirements for Technical Writing, Internships, and Project Management courses

References

Bennekom, F.V. (2002). Customer Surveying. Boston, MA: Customer Service Press.

Bensen, T. & Dharavath, H.N. (2004). Graphic Communications Management (GCM) Program Assessment: A Survey of GCM Alumni on the Curriculum, Journal of Industrial Technology, 20(3), 1-6.

Faiola, A. (1999). The Graphic Communications Curriculum for the next millennium. Journal of Technology Studies, Fall 1999. Bowling Green State University, Bowling Green, OH: 47-49.

Gupta, U.G., & Houtz, L.E. (2000). High School Students' Perceptions of Information Technology Skills and Careers. Journal of Industrial Technology, 16(4), 1-8.

Lashine, S.H. & Mohamed, E.K. (2003). Accounting Knowledge and Skills and the Challenges of a Global Business Environment. Journal of Managerial Finance, 29(7), 3-16.

Lim, E. (1999). Human Resource Development for the Information Society. Journal of Asian Libraries, 8(5), 143-161.

McGourty, J. (1999). Improving Academic Programs by Capitalizing on Alumni's Perceptions and Experiences. 29th ASEE/IEEE Frontiers in Education Conference, San Juan, Puerto Rico.

Mosley, I.T (2001). Computer Management Information Systems and Computer Production Skills Needed by Industrial Technology Graduates as Perceived by Universities and Companies. Journal of Industrial Technology, 17(1), 1-6.

Price, B., Reichgelt, H., & Zhang, A. (2002). Designing an Information Technology Curriculum: The Georgia Southern University Experience. Journal of Information Technology Education, 1(4), 213-221.

Oliver, R. & Towers, S. (2000). Information and Communications Technology Literacy: Getting serious about IT. Proceedings of ED-MEDIA 2000. World Conference on Educational Multimedia, Hyper-

media and Telecommunications. Virginia: Association for the Advancement of Computers in Education.
Senn, J.A. (2004). Information Technology: Principles, Practices, & Opportunities. Upper
Saddle River, NJ: Prentice Hall.
Telecommunications Industry Association. (2004). Telecommunications Industry 2003 Annual
Report. [Online]. Available: http://www.tiaonline.org/ [2004, July 8]. Arlington, VA.
United States Department of Commerce (US DOC), Secretariat on Electronic Commerce (1998).
The Emerging Digital Economy. US DOC, Washington, D.C., April 1998.
United States Department of Labor (2004). Occupational Outlook Handbook. [Online].
Available: http://www.dol.gov/ [2004, May 17]. Washington, D.C.
United States Department of Labor (2004). Career Guide to Industries. [Online].
Available: http://www.dol.gov/ [2004, May 17]. Washington, D.C.
University of Wisconsin-Stout, (2004). Telecommunication Systems Advisory Committee Minutes [Online]. Available: http://cet.uwstout.edu/schloughs/telecom/minutes.html [2004, August 18]. Menomonie, WI.
Wilson, D.G. (2001). Needs Assessment: Implications for Graphic Communications Education.
Visual Communications Journal 2001. University of Houston, Houston, TX: 1-6.
Zargari, A. & Hayes, M. (1999). An Analysis of Industrial Technology (IT) Programs in Meeting Students Needs: A Survey of IT Alumni. Journal of Industrial Technology, 16(3), 1-5.