2010

Defining Workplace Information Fluency Skills For Technical Communication Students

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DEFINING WORKPLACE INFORMAITON FLUENCY SKILLS FOR TECHNICAL COMMUNICATION STUDENTS

by

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A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in the Department of English
in the College of Arts and Humanities
at the University of Central Florida
Orlando, Florida

Summer Term
2010

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ABSTRACT

Information fluency refers to the ability to recognize information needs and to gather, evaluate, and communicate information appropriately. In this study, I treat "information fluency" as both an overall competency and as a collection of knowledge and skills. The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators, to find out how instructors perceive and teach these skills, and to suggest how these findings can inform our teaching practices. Within the framework of qualitative methodology, this study employs two data-collection instruments, including a content analysis of online job recruitment postings and a survey of technical communication instructors across the United States. The study discovers that when hiring technical communicators, employers require candidates to have skills in information processing, information technology, and critical thinking. Candidates must be able to identify their information needs, and must know how to use specified tools to gather, evaluate, and communicate information. It also reveals that although "information fluency" is a new terminology to a majority of instructors, the skill sets that constitute information fluency already existed in their knowledge. The study's last finding suggests that the opportunity for an internship is perceived as the most helpful in students' acquisition of information fluency skills. This dissertation concludes with a list of specific employer-valued information fluency skills, recommendations for program administrators and instructors for implementing information fluency, as well as recommendations for future researches on this subject.

To Zhen and Melody

ACKNOWLEDGMENTS

I would like to take this opportunity to express my deepest gratitude to all those people who have made this dissertation possible and because of whom I will forever cherish my graduate experience at the University of Central Florida.

This dissertation would not have been possible without the guidance of my advisor, Dr. Paul Dombrowski. His patience and support helped me overcome setbacks, focus my ideas, and finish this dissertation. He is always readily available for me, and always read and responded to my drafts with insightful, constructive, and helpful comments. I am also thankful to him for encouraging the use of correct grammar and MLA style in this manuscript. Of course, despite all the assistance provided by Dr. Dombrowski and others, I alone remain responsible for the content of the dissertation, including any errors or omissions that may remain.

Dr. Dan Jones is one of the finest professors I am fortunate to have for my graduate education. He taught me a lot about technical communication theory and practice in his graduate course. With his guidance and support, I was able to find the two most unforgettable internship opportunities at Disney and UCF's Institute for Simulation and Training. He also provided me with unselfish support when I first taught undergraduate technical writing courses. He shared his well-cultivated lesson plans and handouts with me. These materials not only helped my teaching went more smoothly, but also earned me precious time in completing the research for this dissertation.

I am grateful to Dr. J.D. Applen for inspiring and encouraging me to pursue my dissertation on the subject of information fluency. I cannot thank him enough for the long discussions that helped me sort out the focus of my research. I am also thankful to him for always willing to read my writings, comment on my manuscripts and provoke me to explore more in each writing endeavor. He is always there to listen and give me practical advice and encouragements. His online technical writing lesson plans and quizzes also helped me tremendously in my teaching.

I always looked up to Dr. Rudy McDaniel's academic achievement during my course of study. Although I am far from reaching the high standard he has set with his own works, I know he will always be an inspiration to me. His thoughtful questions and revision suggestions helped me transform my dissertation from a prospectus to the final manuscript.

I would also like to thank Dr. Tison Pugh, Director of the Texts and Technology Ph.D. program, who went all the way to secure me a graduate teaching assistantship during my last year at UCF. With this assistantship, I am able to finish this dissertation without financial worries. I am indebted to Dr. Elizabeth Wardle, Director of Writing Programs at the English Department, for graciously accommodating my special situation and allowing me to teach online.

I owe Dr. Karla Kitalong and Dr. Melody Bowdon for numerous discussions and casual chats that gave me confidence and improved my overall knowledge as a graduate student. Their words of encouragement and kindness will never be forgotten.

Many current and former members of the faculty and staff team at the English Department assisted me in various ways during these years. I am especially grateful to Ms. Elizabeth Sloan and Ms. Benita Black whose diligent work made the complicated administrative processes seem like a breeze. I am also grateful to Ms. Deborah Weaver, Ms. Farida Cato (Farrah), Ms. Lindee Owens, Ms. Sharon Body, Ms. Patty Brinkman, Mr. Brooks Pingston at the English Department, and Ms. Shreya Trivedi at the International Services Center, for their various forms of support.

Most importantly, none of this would have been possible without the love and patience of my family. My parents have been a constant source of love and support ever since I came to this world. All these years, my husband Zhen is always there to listen, to give me strength and practical advices on my life and education.

To all the great people I met and worked with—friends, fellow T&T students, professors, colleagues, and to the University of Central Florida, I cannot thank enough.

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CHAPTER ONE: INTRODUCTION

In July 2006, the University of Central Florida (UCF) began implementing the Information Fluency Initiative as the latest 5-year Quality Enhancement Plan (QEP) for accreditation by the Southern Association of Colleges and Schools. This initiative will be implemented campus-wide during the academic years of 2006 to 2010. Through the Information Fluency Initiative, UCF is committed to improving student learning by integrating and infusing information fluency into academic curricula and the campus culture. With the support of the UCF Office of Information Fluency, individual departments and professors are introducing information fluency into their classrooms. Since the launch of the initiative, the university has achieved many accomplishments, including grants to the Department of Philosophy, Department of Nursing, Burnett Honors College, and the School of Digital Media. In addition to university grants, our faculty and staff members have given presentations about information fluency at national and international conferences. They have also published articles that focus on the initiative. The Office of Information Fluency co-sponsored Information Fluency conferences with the Department of Philosophy in 2007, 2008, and 2009. These conferences hosted a total number of 730 participants coming from all academic disciplines ("IF Accomplishments").

As a Ph.D. student specialized in technical communication at UCF, I am excited to see that my university is making impressive progress on the information fluency initiative. At the same time, I am surprised to notice that our academic discipline, technical communication, is not participating in the initiative as much as the nature of our field may require us. In the

Department of English, where the B.A. and M.A. programs in Technical Communication and the Ph.D. program in Texts and Technology reside, we do have a small number of faculty members who are using information fluency -related assignments or modules in their undergraduate and graduate classes. While these assignments and modules do address information fluency from angles that are specific to the course objectives, they have their limitations. Because they are often administered as individual assignments or course modules, they do not provide a holistic, fundamental, and organized view on the subject of information fluency. Furthermore, because of the limited scope of one assignment or even a single course, these attempts often fall short on offering a systematic approach to understanding what it means to be an information fluent technical communicator in today's society and what necessary information fluency skills the students need to be successful both at school and in the workplace.

In today's workplace, information and knowledge has replaced production as the key economic resources (Johnson-Eilola, Drucker). The knowledge workers' productivity is closely related to their ability to manage information and command information technology. Because of this, employers expect college and university graduates to exhibit high levels of competency in critically analyzing information and using technology to access and manipulate information, that is, to be information fluent. As a result, teaching students how to work confidently with available information sources should become an important and urgent topic for educators in any discipline; and technical communication should not be an exception.

Technical communicators deal with information in all aspects of their daily works—from the basic job of conveying technical information to specific audiences, to the more advanced tasks of information design, usability, and knowledge management. We can proudly claim that information is our raw material, our end product, and our tool. However, we are not particularly interested in differentiating information from knowledge, data, and wisdom, nor are we absorbed in Claude Shannon and Warren Weaver's mathematical theory of communication, which introduces the concept of "bit" as a unit of information. Rather, we look at "information" in a broader and more widely-used sense to mean natural, cultural, economical, technological, and any other stimuli that help us make decisions and get our work done.

Technical communication as an academic discipline is also known for emphasizing practical experience. According to Carolyn Miller, we are "both praised and damned for being 'practical'" (14). Seldom do we send off students to the workplace without having provided them with opportunities to learn and practice the genres and procedures that they may encounter at work. While our university is responding to the changing landscape of the workplace by putting effort in building information fluency as a curriculum component in some courses, as researchers and teachers of technical communication we have every reason to resonate with this initiative and put our best effort into building information fluency among our graduates.

The benefits of information fluency go far beyond securing job employments for our graduates. Information fluency not only contributes to university students' academic

achievements and professional successes, but also prepares them for lifelong learning. However, to be able to take advantage of the benefits of information fluency, we first need to establish a basic understanding of it.

This study seeks to explore information fluency in the context of technical communication and to define concrete information fluency skills that the professional field require of our graduates. The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators and to find out how these skills are perceived and taught by university instructors, and to suggest how these findings can inform teaching practices in our profession. I anticipate that the knowledge generated from this inquiry will afford new insights that could inform the technical communication programs' administrative and pedagogical practices. Within the framework of qualitative research methodology, this study uses two data-collection methods/instruments. The first instrument is a content analysis exploring the workplace information fluency skills that employers look for when hiring technical communicators. The sampling is a purposefully selected list of job recruitment postings for technical communicators. The second instrument is an online survey collecting instructors' view and approach to IF skills in their teaching. The participants of the survey are drawn from subscribers of the Association of Teachers of Technical Writing (ATTW)'s e-mail listserv at attw-l@lyris.ttu.edu.

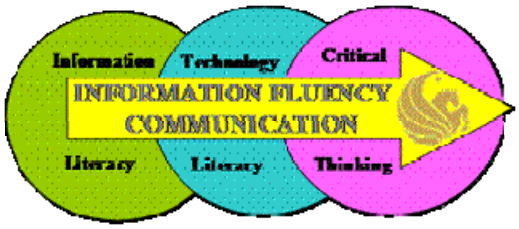
This chapter begins with an introduction to the concept and history of information fluency. Following this is an overview of the context and background that frames the study. Then I present the problem statement, the statement of purpose, and research questions. I also

include in this chapter a brief overview of my research methodology and the upcoming chapters. The chapter concludes with a discussion of the rationale and significance of this study and definitions of some of the key terminologies used.

What is Information Fluency?

One important objective of this study is to define information fluency within the context of technical communication. To do so, I must first review how others have defined it. Several researchers and organizations have attempted to create a measurable definition for information fluency over the years. The definitions vary depending on the kind of institutions and individuals who address it.

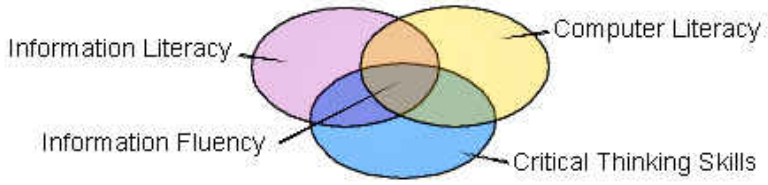
The UCF Information Fluency Initiative Office defines it as "the ability to perform effectively in an information-rich and technology-intensive environment." It is "the ability to gather, evaluate, and use information in ethical and legal ways," and it "encompasses and integrates three important skills: information literacy, technology literacy, and critical thinking" (Figure 1) ("What is Information Fluency?"). The UCF definition outlines both the overall desired outcome and components of information fluency for university students. This rather complete and inclusive definition developed over time and is based on several previous efforts by the Associated Colleges of the South (ACS) in defining information fluency.



http://if.ucf.edu/students/about-if-for-student/

Figure 1: University of Central Florida Information Fluency Model

The ACS, a consortium of 16 private colleges and universities in the South and Southeast United States, is an early proponent of information fluency. It notes that information fluency "may be envisioned as the optimal outcome when critical thinking skills are combined with information literacy and relevant computing skills" ("Definition"). In this definition, information fluency encompasses information literacy, computing skills, and critical thinking (Figure 2).



Rettig and Hagen, http://www.colleges.org/techcenter/if/if_definition.html

Figure 2: The ACS Information Fluency Model

Similarly, Wenxian Zhang at Rollins College suggests that: "the purpose of information fluency is to develop the critical thinking and information literacy skills of students through effective use of technologies" (358). Jeffrey Overholtzer and John Tombarge define

information fluency as "thinking critically about the information needed; understanding the structure and types of information in a discipline; finding information to meet specific needs using search engines, bibliographical databases, and other tools as needed; evaluating the quality of information found; analyzing the information using electronic spreadsheets, statistical analysis tools, and other tools as appropriate, and presenting the information, selecting from electronic and other media as appropriate" (55). Hannelore B. Rader, who serves as the University Library Director at Cleveland State University, provides a broader definition of information fluency and describes it as "the ability to navigate information structures and to evaluate information retrieved through these information structures" (76). According to Rader, information fluency includes "library literacy, media literacy, computer literacy, Internet literacy, research literacy, and critical thinking skills" (76).

A coherent theme emerged from these different attempts to define information fluency—that is, the skills constituting information fluency should come from at least three areas: information literacy, technology literacy/computing skills, and critical thinking. Based on this recurring theme, and by synthesizing the above definitions with the characteristics of technical communicators' work, I am proposing a definition of information fluency specific to the field of technical communication. For technical communicators, information fluency, I posit, means *the ability to recognize information needs, to gather, evaluate, and to communicate information effectively, efficiently, and ethically. An information fluent technical communicator should have practical skills in information literacy (or information processing), fluency with information technology (FITness), and critical thinking* (Figure 3).

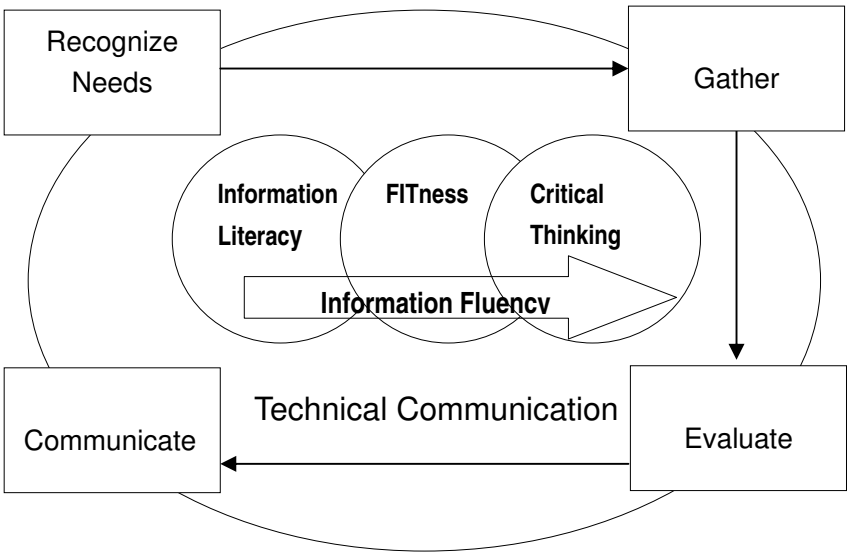


Figure 3: Definition of Technical Communication Information Fluency

In this definition, I replace technology/computer literacy with FITness (fluency with information technology) as one of the three components. I will discuss FITness in detail in Chapter Two, and here I can provide only a brief justification for why I choose FITness as one component while none of the existing definitions have mentioned it. Simply judging by its name, FITness may look similar to technology/computer literacy, but in fact, it bears a much broader implication. FITness requires three kinds of knowledge: contemporary skills, foundational concepts, and intellectual capabilities. According to the National Research Council (NRC), FITness must be understood beyond traditional notions of computer literacy.

> [L]iteracy about information technology might call for a minimal level of familiarity with technological tools like word processors, e-mail, and Web browsers. By contrast, FITness requires that persons understand information

> technology broadly enough to be able to apply it productively at work and in their everyday lives, to recognize when information technology would assist or impede the achievement of a goal, and to continually adapt to the changes in and advancement of information technology. (National Research Council 15)

We can see from this explanation that FITness connotes a deeper level of competency and understanding of information technology than technology/computer literacy. It goes beyond the mastering of a few computer applications, as the term "computer literacy" may suggest. It requires one to learn the foundational concepts of technology and be able to learn new knowledge and skills about information technology independently, even outside of the realm of formal education. In this sense, the scope of FITness is more aligned with the goal of information fluency in terms of its emphasis on lifelong learning, in which individuals continually apply what they know to adapt to change and acquire new knowledge.

Background and Context of the Study

Information is an integral part of any communication, including technical communication. To succeed in the information age, technical communicators must possess more than writing and editing skills. More than a decade ago, Johndan Johnson-Eilola encouraged technical communicators to shake off the image of routine production workers and to re-vision our practices as what Robert Reich defined as "symbolic-analytical work," in which one deals with situations not easily addressed by routine solutions. The symbolic

analyst possesses "the ability to identify, rearrange, circulate, abstract, and broker information" (Johnson-Eilola 255). Cezar M. Ornatowski argued that technical communicators are "decision makers" (576) who function in many decision-making situations using capacities beyond technical or writing skills. Stephen A. Bernhardt suggested that because of our ability to learn and encourage informed practice in a technological world, we can claim a rightful identity as the "agent of change" (602). In the same vein, Michael Huge argued that technical communicators are creators of knowledge who can help the organization making tacit knowledge implicit.

These are excellent recommendations. From different perspectives, the four arguments confirm that the technical communicator's new identity should reflect someone who effectively works with various information resources, symbols, and technologies. They represent a general hope for technical communication's future; they also point out the directions for us to pursue if we are serious about increasing our professional status and values.

The change from an economy based on labor, merchandise production, and capital to one based on information and digital technology requires that the work force of the new economy possess information skills. Today's knowledge workers have more information resources than any of the previous generations. However, more information choices are not making things easier. Because of the excessive amount of information being provided, today's knowledge workers experience "information overload," a psychological and social problem that diminishes the efficiency of the knowledge workforce (Toffler 350).

Information fluency is an essential quality in combating information overload and is becoming an important competency for college and university graduates. Recently, information fluency research and practices have been receiving a considerable amount of attention in academic programs across the country. A number of university-based initiatives and courses are developed based on the ACS information fluency model. Among these are Purdue University's one-credit course, Information Strategies, which focuses on the foundations in information literacy, computer literacy, and critical thinking (Sharkey 83). Cornell University funded the Cornell Undergraduate Information Competency Initiative to encourage faculties to create research assignments that integrate research skills into the classroom and the curriculum (Cornell Undergraduate). UCF developed and launched Information Literacy Online Modules as supplemental resources for use by faculty to help students learn information literacy skills (Information Literacy Modules). According to a 2007 report by George Lorenzo at Lorenzo Associates, there were more than 70 information literacy survey instruments at colleges and universities across the United States (Lorenzo 3).

There are many different assessment tools used by colleges and universities to discover and evaluate students' information fluency-related skills. The four most well-known assessments available are:

- The Educational Testing Service (ETS): *Information and Communications Technologies Literacy Assessment*, or *ICT Literacy Assessment*. The ICT assessment is a Web-based, interactive assessment tool designed to measure problem-solving and critical thinking skills associated with using technology to handle information. This assessment tests both

- Kent State University: *Project SAILS* (Standardized Assessment of Information Literacy Skills). This test is based on Information literacy skills listed in the ACRL (Association of College and Research Libraries) Information Literacy Competency Standards for Higher Education, and it does not cover computer literacy skills.
- The Bay Area Community Colleges: *Information Competency Assessment Project*. This test is also based on the ACRL Information Literacy Competency Standards for Higher Education. Unlike Project SAILS and ICT Literacy Assessment, this one is available for free.
- James Madison University: *Information Competency Exams*. This assessment has two tests—Tech Level 1 test, which must be completed by the end of a student's first semester, and Information Seeking Skills Test (ISST), which must be completed by the end of a student's second semester. (Lorenzo 3-5)

Information fluency is receiving increasing attention in the academic world outside of English departments and technical communication programs. It is receiving great interests from domains such as libraries and K-12 education and is gaining recognition in fields including the sciences, engineering, and mathematics. The many different information fluency initiatives are likely to bring about an educational reform, and this coming reform is the large context in which this study is situated.

Problem Statement

University graduates who are information fluent are valued by employers and corporations as they move beyond the university into the workplace, because of their ability to think critically and to extrapolate useful concepts and ideas from existing information into new applications ("Why Do I Need to be Information Fluent?"). Being information fluent will enhance one's ability to learn new skills and knowledge that are vital to success in many environments. Because our profession in technical communication determines that we work in environments of ever-growing information resources and technologies, we need to prepare our students for such conditions as well. Information fluency should be an important educational objective for technical communication programs. Students of technical communication should obtain the competencies that will allow them to apply information fluency in their course work and future jobs.

Through research, however, I find that despite of its importance to student learning, information fluency is not receiving enough recognition and attention in the technical communication discipline. Our curriculum is not explicitly emphasizing information fluency skills as an important competency for the students. Studies that bring information fluency into the context of technical communication are few and far between. Little research addresses what information fluency means to our field, and how we can systematically and intentionally educate our students to be information fluent.

The lack of research leaves instructors and students of technical communication programs with little to no theoretical and practical guidance in their teaching and learning of

such skills that will contribute to students' success in the workplace. It appears that many students and instructors in technical communication programs have only a vague understanding of the concept of information fluency. The instructors may have been incorporating activities in their assignments that will build information fluency, but they are not aware of the concept itself. At the same time, the student may have received some training in dealing with information, but they are not fully prepared for the complexity and intensity inherent in dealing with information in the workplace.

Both students and instructors of the discipline lack systematic guidance on what make important workplace information fluency skills and how to best incorporate them in the academic setting. Therefore, this study seeks to explore what the employers of technical communicators regard as important information fluency skills, and how teachers of technical communication think they are best implemented in the program.

Statement of Purpose and Research Questions

The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators and to find out how these skills are perceived and taught by technical communication instructors. Because technical communication programs emphasize practical experience, the ways in which information fluency is perceived and experienced in the workplace should influence how it is taught and experienced in academic and professional education programs. Although information fluency as a competency is acquired over time, I believe the process can be accelerated if our goals

are clear and we are fully aware of the tangible skills that eventually build up this competency. My research is focused on defining those specific, tangible skills that will cultivate information fluency in university technical communication students, especially those studying in an undergraduate program. A study like this has never been done before. To shed light on the research problem stated earlier, the following research questions will be addressed:

1. What workplace information fluency skills are valued by employers of technical communicators in the current job market?

2. How do instructors of technical communication perceive information fluency?

3. How do instructors of technical communication teach skills related to information fluency in their classes?

4. What barriers exist in current technical communication curricula that will impede students' acquisition of information fluency skills, and what supports and resources are there to facilitate acquisition?

Overview of Methodology

Within the framework of qualitative methodology, this study employs a combination of qualitative and quantitative instruments for data collection. This research is intended to explore perceptions of information fluency skills not only from the employer's perspective, but also from the academic program's view; not only do I intend to identify trends in recruiting, but also practices in teaching. Therefore, one single method (instrument) alone can

be limiting to serve the purpose of my study, and not allow for getting insights from people within the context and to answer the research questions. Therefore, I use two primary methods:

1. A content analysis on technical communication job postings.
2. An online survey of technical communication instructors.

The following list summarizes the 5 (five) steps I went through to carry out this research.

1. The **literature review**. Preceding the actual collection of data, I conducted a selected review of the relevant literature to study information fluency in terms of its three components. I also looked for the use of collaborative learning pedagogies in technical communication classrooms. This literature review laid the theoretical foundation and conceptual framework for answering my research questions.
2. The **content analysis**. Following the initial literature review, I collected technical communication job recruitment postings from the Society of Technical Communication (STC)'s Technical Communication Career Center and Monster.com, from January to April 2009, as data for the content analysis. With the job posting data collected, I conducted a content analysis identifying specific information fluency skill requirements and preferences of employers. These specific skill requirements were then sorted under the categories and sub-categories of the conceptual framework. Then, I counted the instances of each skill to determine its comparative significance.
3. The **Institutional Review Board (IRB) process**. I designed the survey questionnaire based on result of the content analysis, and then acquired approval from the IRB to

4. The **pilot**. I piloted the survey with 4 technical communication faculty members in two U.S. universities; according to the pilot result and feedback, I revised the survey questionnaire.
5. The **online survey**. I administered the survey using online survey service Survey Monkey and distributed the survey request on the ATTW listserv at attw-l@lyris.ttu.edu. Forty-eight technical communication instructors responded to my request.

Assumptions

Based on my experience from teaching undergraduate technical communication courses, and my background as a technical communicator, I am making four assumptions regarding this study.

- The first assumption underlying the research is that employers require technical communicator candidates to be good at handling information and information technology. This assumption is guided by my own experience working as an instructional writer (an equivalent to technical writer) at the Walt Disney Company and a technical editor at the Institute of Simulation and Training of the

- The second assumption is that information fluency as a term and concept is not popular in the academic world of technical communication. This assumption is based on the lack of research and publications coming from the field of technical communication that either discuss information fluency theory or provide pedagogical advices.
- The third assumption is that, because instructors are unfamiliar with information fluency, their class activities will not include what employers hold to be highly useful and productive information fluency skills. This assumption is based on the premise that instructors will not teach what they are not familiar with themselves.
- The fourth and final assumption is that collaborative learning experiences, such as an internship, can help students learn more practical information fluency skills while still fulfilling their academic requirements. This assumption is guided by the social constructionist theory, according to which, knowledge is constructed and reconstructed through exchanging normal discourses by members of a knowledge community (Bruffee, "Social" 643); and internships can expose

Rationale and Significance

This study is important because it contributes to the general effort of defining (and re-defining) the value of technical communication as a professional field and an academic discipline. The United States Department of Labor (DOL) defines the technical writer's responsibilities as "[w]rite technical materials, such as equipment manuals, appendices, or operating and maintenance instructions" (qtd. in "What's the Difference"). This definition is apparently dated. Today, technical communicators do much more than what is described in the DOL job definition. The STC is working to influence DOL to add a definition of technical communicator to the Standard Occupational Classification System (SOC). The STC office recently began working with economist Rick O'Sullivan to create a description specifically for technical communicators, proposing the following:

> Develop and design instructional and informational tools needed to assure safe, appropriate, and effective use of science and technology, intellectual property, and manufactured products and services. Combine multimedia knowledge and strong communication skills with technical expertise to educate across the entire spectrum of users' abilities, technical experience, and visual and auditory capabilities. ("What's the Difference")

To be able to perform successfully in the job functions listed in the new description, the technical communicator has to be information fluent. Information fluency empowers technical communicators to become symbolic-analysts, decision makers, agents of change, knowledge creators, and subject matter experts. Consequently, the contribution of each technical communicator enables the field and elevates it to a primary knowledge-creating business in the information age—as opposed to simply being classified as a position that specializes in writing manuals and instructions. By examining information fluency in the context of technical communication, this study helps instructors to develop an awareness of it. This is important because information fluency is vital to university students' academic achievements and professional success and will contribute to their lifelong learning process. As an academic discipline, we cannot afford to neglect the development of such skills in our students, who hold the future of the field. This study acknowledges the significance of information fluency, but it does not stop there. It contextualizes information fluency by identifying a list of specific skills technical communicators should know, it also helps instructors and students experience information fluency as an intellectual ability more than information technology or information searching skills.

Second, by identifying the most important information fluency skills for technical communication students, and by investigating the barriers and supporting factors in implementing information fluency in technical communication programs, this study provides references to administrators and instructors of technical communication programs. It will facilitate the teaching and learning of information fluency skills within the discipline. By

doing so, I hope this study will shed light on how we can facilitate information fluency with the changes happening in the technical communicator's professional roles.

Overview of Chapters

This dissertation has six chapters that will be of interest to instructors, program administrators, and students of an undergraduate technical communication program. I will give a brief overview of each remaining chapter (starting from Chapter Two).

Chapter Two: Literature Review

This chapter explores the existing research articles that focus on the following two topics.

Three Components of Information Fluency. Different organizations and researchers define information fluency differently. This study considers information fluency as the seamless combination of three kinds of competencies—information literacy, fluency with information technology (FITness), and critical thinking. Although literature on information fluency per se is rare, each of the three components has been widely discussed, presenting a wealth of information for this study to draw upon. This section examines the relationship between information fluency and learning in respect of these three components. This part of the review informs me that information fluency is a holistic competency and it is the result of the interplay of all three components; it is best acquired through practicing in the knowledge or professional domains that the students wish to enter.

Collaborative Learning Pedagogy in Technical Communication. Collaborative learning is a pedagogical model based on the social constructionist epistemology. According to the social constructionist theory, learning and development is a social, collaborative activity, and students must construct understanding and knowledge in processes facilitated by collaboration. Instructors of technical communication have used collaborative learning pedagogy since the 1980s and are still using it to help students learn many important skills and knowledge of the profession. The implications of collaborative learning enable teachers to go beyond the academic setting and to model the practices and norms of professional communities for their students. Because of this, I include the topic of collaborative learning in technical communication as the second major part of the literature review. In this section, I review the traditional definition of collaborative learning and the pedagogical practices associated with this definition; I will also discuss what I see as the extended meaning and the practices of collaborative learning. This section explores how collaborative learning helps students gain workplace experience and solve workplace problems as they fulfill their academic requirement.

The review and critique of the literature helps me develop a conceptual framework for designing data-collection instruments and interpreting data. After the data are collected, the conceptual framework will become the basic structure for reporting and interpreting the study's findings as well as the analysis, interpretation, and synthesis of these findings. The four categories of the conceptual framework are:

- Workplace Information Fluency Skills for Technical Communicators

- Instructor Perceptions and Attitudes
- Current Implementation
- Barriers and Supports

Chapter Three: Methodology

Chapter three presents the research design and the specific steps I used to conduct this study. This chapter explains the course and logic of my decision making throughout the research process. In particular, I discuss the following areas regarding the research design:

- The rationale for the research approach
- Overview of research design
- The research sample and population
- Two data-collection methods—content analysis and online survey
- How I have analyzed and synthesized my data
- Limitations of the study

Chapter Four: Presentation of Findings

In Chapter Four, I present the findings of this study in two steps. First I list the results of the content analysis and the online survey respectively. My qualitative data include notes from job recruitment postings and survey comments. The data collection methods also generate quantitative data yielding numbers, frequencies, and percentages. My first step is to transfers these raw data into finding statements. Because each of the data-collection methods

generates a number of findings, and are supported with statistics, I feel it is necessary to present them fully in this chapter. They are organized according to the categories of the conceptual framework identified in Chapter Two. They also serve as the detailed material from which I draw the synthesized key findings for the study.

Then, I synthesize the two sets of finding statements into four key findings that serve to answer the four research questions. This step is challenging because I need to reduce the 12 meaningful findings that all the data reveal and reduce them to what is more significant and relevant to answer the research questions. The key findings are strictly qualitative.

Therefore, the findings are presented in three sections: (1) the findings from content analysis, (2) the findings from survey, and (3) synthesized key findings for this study. The four synthesized findings correspond to the research questions.

Key Finding 1: Employers value technical communicators who know what information they need to do their job, who are competent in finding, evaluating, and using information, and who know how to use specified tools to gather and communicate information effectively, efficiently, and ethically.

Key Finding 2: Instructors of technical communication are not familiar with the concept of information fluency, but they think the competencies and skills that constitute information fluency are extremely important in students' potential success in the workplace.

Key Finding 3: Instructors of technical communication are implementing most of the employer-valued workplace information fluency skills in their technical

communication/writing courses; and most of the skills are taught in association with reports and proposals.

Key Finding 4: Most instructors think that students can better learn work-related skills through internships.

Chapter Five: Analyzing and Interpreting Findings

Chapter Five develops an understanding of what lies beneath the data and findings. Whereas the findings chapter split apart pieces and chunks of data to describe the findings separately, this chapter is an attempt to reconstruct a more holistic understanding. In presenting my analysis, interpretations, and synthesis of the findings, I organize this chapter into three analytical categories:

1. Information fluency and workplace demand for technical communicators. (*Research Question 1*)
2. Instructors' attitude and approach to information fluency. (*Research Questions 2 and 3*)
3. Supports and barriers influencing students' acquisition of information fluency in technical communication programs. (*Research Question 4*)

The analytic categories are directly aligned with the study's research questions and the conceptual framework. The chapter concludes with a reexamination of my research assumptions, and a summary that incorporates a note regarding the effect of possible researcher bias in interpreting the findings.

Chapter Six: Conclusions and Recommendations

In the last chapter, I answer my research questions, and discuss major findings and conclusions drawn from this research. There is a conclusion for each finding and, therefore, each conclusion answers each of the four research questions. This discussion is followed by recommendations and a final reflection on this study.

Definitions of Key Terminology Used in This Study

Information Fluency—In this study, information fluency, or IF, means the ability to recognize information needs, to gather, evaluate, and communicate information effectively, ethically, and legally. It encompasses practical skills in information literacy (or information processing), fluency with information technology (FITness), and critical thinking.

FITness—Fitness is short for Fluency with Information Technology. In 1999, the National Research Council defined fluency with information technology as an interplay and balance of three fundamental elements: contemporary skills, foundational concepts, and intellectual capabilities.

CHAPTER TWO: LITERATURE REVIEW

The purpose of this study is to explore the specific workplace information fluency skills valued by employers of Technical communicators and how instructors perceive and teach these skills in the classroom, and to suggest how these findings can inform teaching practices in our profession. As a young discipline and profession, technical communication sees many opportunities for growth in this time when information technology and digital media change the ways we live, work, and learn. Technical communicators were once called technical writers who specialized in making difficult technical material understandable by everyday users. Today, while having excellent communication and writing skills are still the major characteristics of successful practitioners, technical communicators are expanding their specialties into other areas such as information design, knowledge management, usability, and visual design. To meet the expanding responsibilities and growing professional values, technical communicators must show new competencies to match their new status. This study attempts to address one of the many important competencies of technical communicators in the information age—information fluency. I believe being able to understand and master the complex nature of information and information technology, and being able to critically use information for problem solving and analytical thinking is becoming ever more critical for the success of the practitioners as well as for the advancement of the field of technical communication.

Teachers of technical communication are constantly looking for new approaches and pedagogies to better prepare students for the advancements and changes happening in the

professional field. Some put special attention on Web and information design, some emphasis teaching practical software applications, and others still stress the importance of rhetoric theories as fundamental to all skills, technical or otherwise. Clearly, technical communication is meeting the challenges of the information age in order to embrace its opportunities. This study aims at contributing to such an effort by identifying the specific workplace information fluency skills valued by employers. To carry out this study, it is necessary first to complete a critical review of current literature.

The literature review includes two major topics: *the three components of information fluency* and *collaborative learning pedagogy in technical communication*. The topic on information fluency has three parts—information literacy, fluency with information technology (FITness), and critical thinking, each presenting the definitions and major issues around the particular component under discussion. This part of the review shows that information fluency is composed of different sets of skills that are acquired over time, and the three components are tightly intertwined with one another in forming the competency of information fluency—missing any one component will fail to create information fluency.

Nurturing those skills requires that teachers expose and immerse students in a social context similar to the workplace, which makes collaborative learning pedagogy an important topic to be examined in the second part of the literature review. Among the socially based pedagogical practices in technical communication, I find collaborative learning serve best in providing the social and rhetorical contexts for teaching workplace information fluency skills. According to the social constructionist theory, learning and development is a social,

collaborative activity. The theories of developmental psychologist Lev Vygotsky has become known as social constructivism because his theories stress the critical role social contexts play in cognitive development. Students are more likely to learn the skills that manifest information fluency when they actively engage in the context of the knowledge domains. Because of this, I include the topic of collaborative learning in technical communication as the second major part of the literature review.

The second topic focuses on examining the history and application of collaborative learning pedagogy in technical communication curriculum. By presenting a traditional and an extended meaning of collaborative learning, this part presents studies and discussions on how to immerse students in the workplace context while fulfilling academic requirements. After the two-part literature review, I will also present a conceptual framework that will serve as a map to organize empirical data and an outline to explain the findings.

Three Components of Information Fluency

Different organizations and researchers define information fluency differently. This study considers information fluency as the seamless combination of three kinds of skills—information literacy, FITness, and critical thinking. Although the literature on information fluency per se is relatively sparse, researches related to the three components have been vigorous over the past several years. These researches present a wealth of information for this study to draw upon. The scholarly and professional literature from these areas will help us better understand information fluency's influence in students learning. And

understanding of the key concepts in these three areas will also help us make sense of information fluency that is otherwise known only partially. I will begin this part with the first component, information literacy.

Information Literacy

The American Library Association (ALA) was the first among the library and academic community to respond to the emerging concept of information literacy. The ALA Presidential Committee on Information Literacy suggested in 1989 that information literacy was critical for education and lifelong learning. It called information literacy a survival skill of the information age, which includes a set of abilities requiring individuals to “recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information" (American Library Associations). The ALA defined information resources widely, suggesting that information could come from “a computer, a book, a government agency, a film or any number of other possible resources” (American Library Associations). It envisioned information literacy as not only being able to “enhance the critical thinking skills of students, but will also empower them for lifelong learning and the effective performance of professional and civic responsibilities” (American Library Associations). ALA also suggested that because information literacy is important to individuals, business, and citizenship, it should be established as a part of formal education and then continues throughout a person’s life time.

A decade later, the ALA report evolved into the Information Literacy Competency

Standards for Higher Education. The standards were reviewed by the Association of College and Research Libraries (ACRL) Standards Committee and approved by the Board of Directors of the ACRL in 2000. I will refer to it as the "ACRL Standards" hereafter. The ACRL Standards is the most well-known and widely-adapted information literacy standards among colleges and universities worldwide. It provides five standards that present a common framework for defining and assessing information literacy. The five standards are:

1. Know. The information literate student determines the nature and extent of the information needed.
2. Access. The information literate student accesses needed information effectively and efficiently.
3. Evaluate. The information literate student evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.
4. Use. The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose.
5. Ethics/Legal. The information literate student understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally. (Association of College & Research Libraries)

The ACRL Standards addresses the importance of information literacy to learning, yet this approach is rather school-centered. Because information literacy forms the basis of lifelong learning, it should enable people to take control over their own learning, regardless

of disciplines, learning environments, and levels of education. The ACRL standards' school-centeredness is not coherent with the ALA's original spirit to establish information literacy as a lifelong quality. In order to complement the library and school's perspective of information literacy, we will now take a look at discussions about information literacy in the context of the workplace.

In the preface to his book Information Literacy and Workplace Performance, Tom Goad remarks that information literacy is a skill that "can and must be mastered for success in the future workplace," and it is the "one skill we can master to fulfill our workplace dreams, regardless of what we do.... that skill is information literacy, which is being able to locate, access, select, and apply information" (ix). According to Goad, information literacy impacts workplace performance in terms of "Communication," "Thinking," "Decision making," and "Continuous Learning/Learning How to Learn" (122-123). To him, being information literate means having information power. When discussing information literacy and workplace success, he proposes that a person who is information literate:

- Recognizes that accurate and complete information is the basis for intelligent decision making
- Recognizes the need for information
- Formulates questions based on information needs
- Identifies potential search strategies
- Develops successful search strategies
- Access sources of information including computer-based and other technologies

- Evaluate information
- Organizes information for practical application
- Integrates new information into an existing body of knowledge
- Uses information in critical thinking and problem solving (206)

In a similar context but with a different focus, Christine S. Bruce, Professor of Information Technology at Queensland University of Technology, investigates workplace information literacy experience among various types of professionals. Bruce interviewed her research participants and asked them to focus on their experiences of information literacy at work. Bruce claims that her participants maintain that information literacy contributes to "maintaining currency, networking, problem-solving and maintaining a client-orientation" (43). Through her study, she identifies seven different ways professionals experience information literacy. In what she calls the seven "faces," information literacy is experienced as:

1. Using information technology for information awareness and communication
2. Finding information from appropriate sources
3. Executing a process
4. Controlling information
5. Building up a personal knowledge base in a new area of interest
6. Working with knowledge and personal perspectives adopted in such a way that novel insights are gained
7. Using information wisely for the benefit of others (36-42)

Up to now, we have reviewed the discussions of information literacy as perceived in both the academic and professional world. The academic interpretation (ALA, ACRL) of information literacy focuses on information finding and processing skills. While the discussions on workplace information literacy (Goad, Bruce) also emphasize these skills, they highlight the ability to use information technology to find, organize, and communication information as well. Like Goad, Bruce's intention with the term "literacy" includes the characteristics of the combination of all three aspects of information fluency. For example, on the issue of technology, the ACRL standards states: "information literacy initiates, sustains and extends life long learning through abilities which may use technologies but are ultimately independent of them" (Association of College and Research Libraries 4). On the other hand, Goad and Bruce suggest it is important to access information sources using "computer-based and other technologies" (Goad 206) and "using information technology for information awareness and communication" (Bruce 36). They also incorporate elements of critical thinking into their interpretation of information literacy by stating that professionals should be able to use information "in critical thinking and problem solving" (Goad 206) and to work with "knowledge and personal perspectives adopted in such a way that novel insights are gained" (Bruce 41).

Both Goad and Bruce's interpretations of workplace information literacy carry elements in technology and critical thinking. They are similar to the overall scope of information fluency. There is no wonder that sometimes information literacy and information fluency are used interchangeably in this regard. However, in spite of these similarities, this

study is by no means treating the two concepts (information literacy and information fluency) as equals. In the span of this study, information fluency is more full-blown and more fluid in all three areas, and information literacy may suggest them to a lesser degree.

In summary, although the above discussions on information literacy present two groups of thought and remain separate in their focus, they do share some commonalities and they all agree that some abilities are essential to information literacy. These abilities are:

- Recognizing when information is needed,
- Acquiring needed information,
- Organizing and evaluating information, and
- Communicating information.

Fluency with Information Technology (FITness)

The National Research Council (NRC) states that: "information technology is a medium that permits the expression of a vast amount of information, ideas, concepts, and messages" (15). In 1997, in response to a request from the National Science Foundation to address the subject of information technology literacy, the NRC initiated a study to lay the framework for fluency with information technology. This section introduces the FITness framework as laid out by the NRC and discusses its connections to the technical communication curriculum.

Before diving into that conversation, let us take a brief look at how technology is viewed within the discipline of technical communication.

Tools vs. Technology

In the field of technical communication, there are generally two attitudes toward the teaching and learning of new technologies: the tool-oriented perspective and the technology-oriented perspective. The first perspective emphasizes acquiring practical skills in using specific digital tools and software applications. The technology-oriented perspective is less interested in specific software application, and highlights the importance of a broad understanding of the principles of a certain *type* of technology in order to develop the ability to learn new tools.

Although often confused for one another, tools and technology are not the same. If we consider tools as specific software programs, then several similar programs (tools) form a *type* of technology. For example, FrameMaker and Pagemaker are two different tools, and they are both under the category of desktop publishing technology. Again, Dreamweaver, HTML, and CSS are tools for Web development, and the totality of Web development tools is considered a type of technology.

Dave Clark and Rebekka Anderson point to the tendency among technical communicators to demonstrate strong interest in tools of the trade, including tools for desktop publishing, translation, and Web development. They argue that technical communicator's focus on tools reinforces the limited perception others (i.e., executives, subject matter experts, project partners) have of our abilities and potential. Saul Carliner warns us of the danger of becoming tool jockeys:

> Because we overemphasize the role of tools in our work, we get pegged as tool jockeys rather than communicators—asked only to convert a file from Word to RoboHelp rather than asked to write the text in the file. (273)

For proponents of the technology-oriented perspective, the tool-centered perspective keeps the learning of information technology only at a superficial level, and makes it ephemeral and unsustainable. They argue that it is difficult for any technical communication academic program to keep up with the rapid pace at which information technology tools are produced and upgraded. As Laura Gurak and Ann Hill Duin suggest, software changes far faster in industry than in higher education and our programs cannot afford to teach the most current software, because any specific tool we teach in school is likely to become outdated by the time the students graduate.

As teachers, we want our students to succeed beyond the classrooms, we want them to quickly and smoothly adapt to the workplace. We not only need students who graduate with competencies in using certain tools, but are also "comfortable in cyberspace, familiar with information protocols, conversant within the new media, and at home in virtual environments" (Bernhardt 602). Focusing too much on tools with no knowledge of technology will limit the students' abilities to upgrade their own technological skills. Therefore, we need a more holistic and more fundamental understanding of technology. We should find a middle ground between the tool and the technology.

Our students should learn computer applications, but they should also know the fundamentals of technologies, and synthesize what they know about technology into solving

complex problems and fostering high-level thinking. This is the framework of FITness.

Fluency with Information Technology (FITness)

The NRC gives a broad definition of information technology to "include computational devices, associated peripherals, operating environments, application software, as well as embedded computing devices, communications, and the science underlying the technology" (viii). Rather than using the term "literacy" for the study, the committee chooses "fluency" because fluency "connotes the ability to reformulate knowledge, to express oneself creatively and appropriately, and to produce and generate information (rather than simply to comprehend it)" (2). Terms like computer literacy and technology literacy connotes having the basic skills to use computers. While basic skills are needed to function in today's workplace, the rapid changes and developments in technology often require higher-level skills that allow individuals to function effectively and quickly adapt any changes. FITness is intended to lay an intellectual framework for using information technology, and is adaptable to various disciplines.

Being fluent with information technology goes beyond merely knowing how to use the computer, just like being fluent with a language means more than knowing the vocabulary and grammar. It requires that individuals "understand information technology broadly enough to be able to apply it productively at work and in their everyday lives, to recognize when information technology would assist or impede the achievement of a goal, and to continually adapt to the changes in and advancement of information technology" (National Research

Council 15). According to the report, FITness comprises three kinds of knowledge: *contemporary skills*, *foundational concepts*, and *intellectual capabilities* (See Appendix A for a full list of the components and skills of FITness). Technical communication programs should take advantage of the flexibility of FITness and find ways to incorporate contemporary skills, foundational concepts, and intellectual capabilities into the students' learning agenda.

Contemporary Skills

Contemporary skills refer to the ability to use computer applications and tools. According to the NRC report, skills are an essential component of job readiness in the present labor market. More than securing a job, skills also provide the technical communicator with practical experience on which to build new competencies.

Michael J. Albers, after attending a panel that examined the future skills and technology needs of technical communicators at the 2004 STC Annual Conference, concludes that there has been a change in employers' hiring over the past 10 years. Unlike the 1990's, when the ability to write was the critical standard for hiring, today what employers expect is an "expanded set of skills to complement their writing ability, skills that depend on various aspects of technology" (Albers 269).

Technical communicators and scholars are divided about whether we should teach students the latest tools and software skills. Many researchers tend to believe it is too narrow-sighted to emphasis teaching the tools (Clark and Anderson, Carliner, Gurak and

Duin). However, a most recent study by Clinton Lanier suggests differently. By studying 327 job recruitment posting for technical writers, Lanier found that many employers called for proficiency in one or many different types of tools, and among them, general software skills (like using Microsoft Word) are in the highest demand. Next on the list came publishing and graphic software, which are closely related to technical communicators' daily job functions (Figure 4).

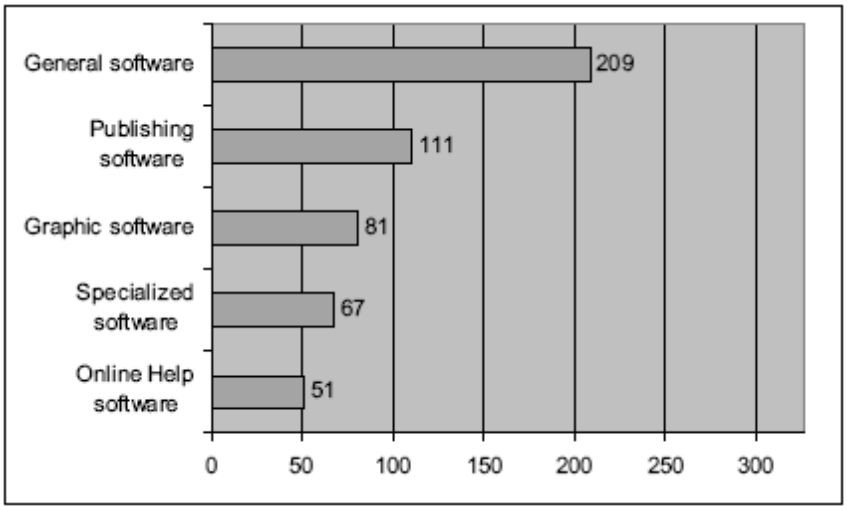


Figure 4: Number of Calls for Tool Knowledge for Technical Writers (Lanier 58)

Lanier's study result may ease some of the concerns that the tools we teach at school cannot catch up with the speed of change, because general software do not change as fast as specialized tools. Even with fast-changing specific software tools, technical communication students still need to know some of them, for knowing one allows them to adapt quickly to similar tools at work. It takes us back to the tools vs. type of technology discussion. For example, Lanier suggests, knowing Adobe InDesign allows one to quickly learn and understand Dreamweaver.

Having contemporary skills with technology are not enough. Albers suggests that "technology skill set is simply what's needed to get a first job; technical communicators need to continue to learn new technologies and tools to remain competitive and employable" (269). With a firm grasp of the foundational concepts of technology, technical communicators are able to see the trees and forest at the same time; and the "big picture" view will help them learn new tools very quickly.

Foundational Concepts

Foundational concepts are the basic principles and ideas that underpin technologies. They help us consider how technologies interact and influence one another. To avoid overemphasizing tools in our curriculum, which may risk turning our students to tool jockeys, there must be a mixed amount of tool-based instruction and the "why and how" of technology, as well as critical thinking skills.

Stuart Selber suggests that simply keeping pace with the rapid technological changes is not enough. We must also "critically explore and carefully evaluate both the potential and the peril of those new technologies with our students, and we must develop productive strategies for introducing this instruction into existing curricular" (384). If combined within the context of technical communication program, contemporary skill and foundational concepts are similar to what Gurak and Duin discuss as "courses that provide both the theoretical overview of an issue (theories of single sourcing and tag language, for example) and also the hands-on training on tools that help students understand industry standards" (189).

Intellectual Capabilities

In my opinion, intellectual capabilities are where the "fluency" factors are manifested most within FITness. They are also the most difficult of the three types of FITness knowledge. The NRC defines intellectual capabilities as "the ability to apply information technology in complex and sustained situations, encapsulate higher-level thinking in the context of information technology" (3). For teachers and students, the first two kinds of knowledge in FITness, contemporary skills and foundational concepts, are seemingly achievable and assessable. However, intellectual capabilities are not as easy to achieve in academic programs partly because the lack of "complex and sustained situations" and the "context of information technology" in pure academic settings. If our students cannot translate contemporary skills and foundational concepts into critical application, they are much less empowered to manipulate the digital media and to use the technology to their advantage. Being able to make informed decisions and to think about communication and information critically are important requirements our students must meet in the workplace. They need to develop intellectual capabilities to claim fluency with information technology.

In this sense, the intellectual abilities are closely related to critical thinking skills, which I will discuss in the following paragraphs.

Critical Thinking

There is much debate about the exact definition of critical thinking. The contemporary

definitions of the term range from simple to complex. Some consider critical thinking as a component of everyday actions. For example, Robert Ennis offers a concise definition of critical thinking as "reasonable reflective thinking that is focused on deciding what to believe or do" (10). Others view critical thinking as a particular quality in forming and communicating arguments. Peter Fancione defines critical thinking as being able to construct and evaluate arguments. Christine Furedy and John J. Furedy define it as the ability to "identify central issues and assumptions in an argument, recognize important relationships, make correct inferences from data, deduce conclusions from data provided, interpret whether conclusions are warranted on the basis of the data give, and evaluate evidence or authority" (qtd. in Gellin 746).

Still others look at critical thinking as the ability to raise questions and come to well-reasoned conclusions or solutions. John Dewey proposes that critical thinking involves the suspension of judgment and healthy skepticism. According to Richard W. Paul, "Critical thinking is the intellectual disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by observation, experience, reflection, reasoning, or communication, as a guide to belief and action" (22).

Together, Richard W. Paul and Linda Elder suggest that the critical thinking person:

- raises vital questions and problems, formulating them clearly and precisely;
- gathers and assesses relevant information, using abstract ideas to interpret it effectively;

- comes to well-reasoned conclusions and solutions, testing them against relevant criteria and standards;
- thinks open mindedly within alternative systems of thought, recognizing and assessing, as need be, their assumptions, implications, and practical consequences; and
- communicates effectively with others in figuring out solutions to complex problems. (4)

Whether it is about reflective thinking of everyday activities, constructing arguments, or reaching well-cultivated solutions, critical thinking skills can be applied to any domain or knowledge base. However, this does not mean it is generic. Teachers should not attempt to teach critical thinking in its own right—without applying it to specific subject areas and disciplines. John McPeck, Richard W. Paul, Pete Reffell and Andrew Whitworth have all analyzed this issue.

McPeck insists that critical thinking is always about some subject and there is no such a thing as generic critical thinking skills. For Paul, critical thinking includes examples of modes of reasoning specific to subjects and disciplines. He insists that students must learn to reason within the characteristic modes of thinking of the various fields of study; they should learn to reason historically, sociologically, psychologically, and biologically.

> Critical thinking—in being responsive to variable subject matter, issues, and purposes—is incorporated in a family of interwoven modes of thinking, among them scientific thinking, mathematical thinking, historical thinking,

> anthropological thinking, economic thinking, moral thinking, and philosophical thinking. (Paul 22)

Critical thinking not only does not exist independent of a specific subject domain and discipline, it also does not exist as a single task by itself. It must exist with activities. When it comes to critical thinking about information and technology, Reffell and Whitworth argue that we should talk in terms of "information comprehension" (432). They argue that students must know the context and appropriateness of the information and have "an understanding of the social, historical and political background from which the information has developed, and which has shaped its form" (433). They suggest that students should be able to become participants of information domains and public spheres, be encouraged to produce information, and be able to criticize what already exists.

Although critical thinking stands as one individual component of information fluency, it cannot be separated from the other two components: information literacy and FITness. Just like getting physically fit involves actually working on the muscle groups (as opposed to just thinking about getting fit), exercising the muscles for critical thinking also requires doing. We cannot help our students to achieve information literacy and FITness in isolation from critical thinking skills, and without critical thinking, the other two are impossible to achieve. This inseparability demonstrates that information fluency is a holistic competency that requires one to exercise all three skill sets.

We think critically for a reason. Thinking critically about information and information technology must happen simultaneously with information literacy and FITness. If our

students do not have critical thinking skills, they cannot achieve what had been discussed about information literacy, and they cannot be fluent with information technology. On the other hand, if they do not engage in the actual activities of finding and organizing information and using technologies, they have no venues to sharpen their critical thinking skills. So, it is safe to say that critical thinking is already imbedded in the activities of information literacy and FITness. I made a remark earlier about observing critical thinking requirements in the discussion of information literacy and FITness, and I would like to re-emphasize it. Information literacy, FITness, and critical thinking cannot be artificially separated, although we list them as three separate components of information fluency. In the process of problem solving, these three components are one.

Paul emphasizes the importance of sharpening reasoning skills with an end in mind:

> We do not achieve excellence in thinking with no end in view. We do not design for no reason; we do not fashion and create without knowing what we are trying to fashion and create. We do not originate and produce with no sense of why we are doing so. (23)

In academic programs, the reason and "end in view" for critical thinking are the various philosophical and practical issues that surround and compose a discipline. Gerald M. Nosich comments on critical thinking within a discipline in this way: "Critical thinking in a field is thinking things through in terms of the concepts of the field" (94). He suggests that critical thinking in biology is thinking biologically. Critical thinking in the field of anatomy is thinking anatomically. And critical thinking in nursing is thinking the way "an observant,

informed, and reasonable nurse thinks" (Nosich 94). Likewise, we may say that critical thinking in technical communication is thinking in the way an informed, analytical, and innovative technical communicator thinks. But the question now becomes "How do teachers of technical communication teach these skills holistically in an academic setting?" Burback et al. suggest exercises such as service learning, group projects, and case studies can help build students' critical thinking skills. In this study, I regard these activities as part of the collaborative learning pedagogy.

In the following part, I review literatures devoted to the theory and practice of collaborative learning pedagogy in the technical communication curriculum.

Collaborative Learning Pedagogy in Technical Communication

From the previous discussions we see that information fluency is a holistic competency combining several core skills that develop gradually within specific knowledge domains. Students are more likely to learn the skills that manifest information fluency when they actively engage within the context of knowledge domains. Furthermore, students are more likely to acquire these core skills when working in teams rather than as individuals, and in solving workplace problems rather than in dealing only with classroom assignments.

According to the social constructionist theory, learning and development is a social, collaborative activity. The theories of developmental psychologist Lev Vygotsky has become known as social constructivism because his theories stress the critical role the social context for cognitive development. According to the social constructivist theory, students must

construct understanding and knowledge in processes facilitated by collaboration. Also according to Cleborne D. Maddux, Dee LaMont Johnson, and Jerry Willis, programs that support collaborative problem-solving and interactive decision making enrich the learning environment. Therefore, I include the topic of collaborative learning in technical communication as the second major part of the literature review.

Collaborative learning is a pedagogical model based on the social constructionist epistemology. It is directed at higher education and was first introduced by Kenneth A. Bruffee in his 1993 book Collaborative Learning: Higher Education, Interdependence, and the Authority of Knowledge. Instructors of technical communication have used collaborative learning pedagogy since the 1980s and are still using it to help students learn many important skills and knowledge of the profession. The implications of collaborative learning enable teachers to go beyond the academic setting and to model the practices and norms of professional communities for their students. In this section, I review the traditional definition of collaborative learning and the pedagogical practices associated with this definition; I will also discuss what I see as the extended meaning and practices of collaborative learning. The theme of this section is how collaborative learning helps students gain workplace experience and solve workplace problems as they fulfill their academic requirement.

Social Constructionist Theory and Collaborative Learning Pedagogy

In the social constructionist view, knowledge exists in social groups, or knowledge communities. Focusing on the cognitive development of children, Vygotsky's well known

concept of the “Zone of Proximal Development (ZPD)” argues that children can, with help from adults or more advanced peers (which form a knowledge community), master concepts and ideas that they cannot understand on their own (Vygotsky 79-91). The same psychological processes in knowing also apply to adult learning. Bruffee stresses that knowing is mediated; it is “a disjunctive, mediated process involving the agency of other people” (Bruffee, “collaborative” 117).

Social constructionists believe knowledge is constructed and reconstructed through exchanging “normal discourses” (Bruffee, “Social” 643) by members of a knowledge community, or as Bruffee called them, “knowledgeable peers” (“Collaborative” 777). The social constructionist theory, therefore, focuses on helping students adapt to the communal norms and the normal discourses of the communities they will enter as professionals; because "not to have mastered the normal discourse of a discipline, no matter how many 'facts' or data one may know, is not to be knowledgeable in that discipline " (Bruffee, “Collaborative” 777).

The teachers’ job, then, is to engage students in rational argument and conversations about the normal discourse of the knowledge communities. Through this process, students come to understand how a given community uses discourse to reach consensus about knowledge, Charlotte Thralls and Nancy Roundy Blyer point out (250).

Bruffee sees collaborative learning as the ideal pedagogy which will provide the social context in which normal discourse can occur. He suggests that collaborative learning is based on the rationale that the task of learning to think and write as a knowledgeable peer is not an individual activity but occurs through interactions (“Social” 640). Collaboration allows

interactions not only among students, but also between the classroom and the workplace environment. The interactions provide students with the social contexts in which they can "practice and master the normal discourse exercised in established knowledge communities in the academic world and in business, government, and the professions" (Bruffee, "Social" 644).

Collaborative learning is also a useful approach to technical communication education because it gives students opportunities to experience the ways in which professionals actually live and work. Thralls and Blyer believe that including collaboration in technical communication classes will enable students to be acculturated to the workplace.

> [C]lassroom activities involving collaboration will best encourage collaborative learning and thus best facilitate students' acculturation to professional communities. (252)

The most common technical communication classroom activities that manifest collaboration (collaborative learning) include *peer review* of documents and *team writing*. These activities facilitate students in gaining "experience with collaborative writing as it is used in the business and professional worlds," according to Meg Morgan et al. (20). These activities represent collaborative learning in its traditional sense—that is, collaboration between students and between students and teachers. But these collaborative traditions present some limitations. Activities such as peer review and team writing in the classroom tend to enable interactions that happen only among students and do not provide the contexts of the knowledge community which the students will enter after graduation. Ann M.

Blakeslee suggests that in learning professional genres, students must be "immersed in a community, interact with the members and artifacts of the community, participate in and adapt to the social actions of the community, and appropriate the routinized tools-in-use of the community" (170). Collaborative learning in the classroom and interactions only between students seldom permits immersion and acculturation to a professional community. So, I propose that we consider collaborative learning more broadly to include the collaboration between the classroom and the workplace.

In the following paragraphs, I will review an extended meaning of collaborative learning—classroom-workplace collaboration and its many forms.

Classroom-Workplace Collaboration

Classroom-workplace collaboration, I suggest, is a broadened and comprehensive method of collaborative learning. It refers to the collaboration between the students and their knowledgeable peers, between the students and the rhetorical situations of the workplace, and in general, between their classrooms and the professional communities they will enter after graduation. Aside from mirroring professional communities via peer review and team writing, technical communication instructors often apply other types of activities to simulate workplace practice that often require cooperation from non-academic organizations and companies. Such activities include case studies, client projects, service learning, and internship.

The case studies approach has been adopted as classroom assignments that embody

the simulation of workplace situations. Researchers such as John L. DiGaetani (187-188) and Michael Mendelson (204) strongly promote the case assignment as a simulation of workplace writing because it recreates on-the-job situations, audiences, and rhetorical problems. According to Cyril H. Knoblauch, cases "attempt to construct the desired social, political, rhetorical, and other circumstances that impinge on the choices writers make in practical settings" (257). Lynn P. Rozumalski and Michael F. Graves' study indicates that the case assignments generally produced more effective writing products than did traditional assignments (1).

Even so, the case method still has its limitations. Critiques of this method are mainly directed at the lack of social context and organizational environment information. Aviva Freedman, Christine Adam, and Graham Smart suggest that differences in the contexts of school and workplace limit teachers' attempts to simulate and teach workplace genres through case assignment. They argue that classroom writing on cases differs significantly from workplace writing and does not fully convey important features of professional genres, such as the rhetorical contexts and the social actions entailed by them.

> The reader/writer relations, the social roles adopted, the reading practices, the collaborative composing processes, and above all, the social motive governing the production of the genre of case-study writing were all fundamentally distinct from those in the parallel workplace. (Freedman, Adam, & Smart 221)

Knoblauch also insist that workplace practices "are embedded in additional layers of social reality and cannot be understood—or learned—apart from them" (257). Linda Driskill

argues that context "is a source of meaning for writers and readers [as is] experience in their particular roles in an organizational context" (129). Freedman, Adam, and Smart also suggest that "only through similar exposure to relevant professional contexts, with the situated learning entailed, will writers acquire the genres appropriate to these milieus" (222).

The client project, service learning, and internship are, therefore, more promising in providing the contexts that the case assignment fails to provide. The immediate benefits of using client project in the technical communication classroom are documented by researchers like Ann Blakeslee and Gregory Wickliff. According to Blakeslee, client assignments that involve actual workplace projects are different from the case study assignments. By asking students to complete real workplace projects provided by clients, this method preserves more of the culture of the workplace, and allows students to address a variety of audiences. Blakeslee suggests that client projects expose students "to the cultures and activities of the workplace and gradually introducing them to the genres that both arise from and support those cultures and activities… These projects also can act as useful transitional experiences for our students: students can get a taste of workplace writing practices while still having the guidance and support of their instructor and classmates" (170).

Wickliff also points out the differences between case and client project assignments. He insists that project is a compromise between the conventional case method and a more lengthy individualized internship or cooperative education experience. "The projects reinforce research, analysis, and reporting skills, such as interviewing specialists and conducting survey research, that graduates continue to value highly even after years of

workplace writing"(Wickliff 170). According to Wickliff, client projects also foster the social negotiation skills involved in problem definition, research, analysis, and reporting. "Among the skills graduates currently value most are those of preparing for, and conducting, surveys and personal interviews with specialists—complex tasks that may not be simulated well by the traditional case method" (Wickliff 171).

Service learning courses are another effective way to bring the professional community into the classroom. According to Melody Bowdon and J. Blake Scott, service learning courses use "community service as a vehicle for teaching specific course-based skills and strategies" (1). According to Catherine Matthews and Beverly Zimmerman, the benefits of service learning include "development of civil values," "improved academic learning," and "motivated students" (385). Service learning courses usually take place between the classroom and non-profit organizations. Therefore, besides providing professional contexts for the students, they also provide students with education in citizenship. David Alan Sapp and Robbin D. Crabtree describe service learning as the "laboratory in citizenship," which makes "connections between theory and practice, the academy and the community, and inquiry and social action" (412).

Still another collaborative approach to encourage community and real-world experience for technical communication students is through internship. In an internship, students spend a semester or longer working on-site for a company. While the client project and service learning projects can provide a rich amount of workplace contexts, the learning environments they provide are still the classroom. The internship experience place the

students within the *actual* work environments so they can apply theories and practices that were learned in the classroom, and to interact with the professionals of the field. Carolyn Miller calls internship one of the "mechanisms for channeling the relation" between "instruction and practice of technical writing" (19).

Social constructionist theories stress that meanings are socially negotiated between individuals in a community. As a pedagogical interpretation of the constructionist theory, collaborative learning emphasizes that knowledge is constructed and reconstructed through exchanging discourses among knowledgeable peers. The critical literature review in this section examines collaborative learning in its traditional form—collaboration between students and their peers, and between students and the teacher. In addition, this section also proposes an extended meaning of collaborative learning—collaboration between the workplace and the classroom, or "industry-university collaboration" (Miller 19). In Table 1 below, I list the characteristics, advantages, limitations, and major forms of each interpretation, hoping to visually display their similarities and differences.

Table 1: Comparison of Traditional and Extended Interpretations of Collaborative Learning Pedagogy

Collaborative Learning Pedagogy in Technical Communication				
	Characteristics	Advantages	Limitations	Major Forms
Traditional	• Classroom activity • Interaction among students • Peer-to-peer	• Gain experience with collaborative writing	• Classroom-bond context • No immersion in professional community	• Peer review • Team writing
Extended	• Classroom to professional community • Peer-to-knowledge peers	• Immersion • On-the-job situations • Professional context and environment	• Lack of social context and professional environment (Case Studies Only)	• Case • Client project • Service learning • Internship

If we hope to foster in our students the ability to define problems regarding information and the ability to negotiate satisfactory solutions, we should value classroom-workplace collaboration methods, because it is commonly agreed that these methods provide the social contexts, the communal norms, and the social dynamics involved in solving and negotiating meanings.

The critical review of the above literature has helped me develop a conceptual framework for designing data-collection instruments and interpreting data. In the following paragraphs, I will explain the importance of the conceptual framework to this study and discuss its categories and sub-categories.

Conceptual Framework

The conceptual framework consists of categories that come out of the literature review. According to Linda Dale Bloomberg and Marie Volpe, "the review and critique of existing literature culminates in a conceptual framework that posits new relationships and perspectives vis-à-vis the literature reviewed. In this way, the conceptual framework becomes the scaffolding of the study. Most important, it becomes a working tool consisting of categories that emanate from the literature" (58). These categories will serve as a map to organize empirical data and an outline to explain the findings. The conceptual framework plays a central role in the research process and in the analysis of findings. After the data are collected, it will provide the basic structure for reporting and interpreting the study's findings as well as the analysis, interpretation, and synthesis of these findings.

To reflect the four research questions outlined in Chapter One, I designate four categories to the conceptual framework. In other words, the categories are directly tied to the research questions; and there is one category per research question.

The first research question seeks to find out the workplace information fluency skills valued by employers of technical communicators. Therefore, the conceptual category to capture answers to this question would be "Workplace Information Fluency Skills for Technical Communicators." The second question seeks to identify how information fluency skills are perceived by teachers of technical communication. The category entitled "Instructor Perceptions and Attitudes" is appropriate. The third question tries to answer how instructors teach skills related to information fluency in their classes, and the category will be "Current

Implementation." The fourth research question is intended to examine the barriers that impeded information fluency implementation and to uncover resources and possibilities that will better facilitate information fluency among students. So, the appropriate categorization is "Barriers and Supports."

To further explain each of the categories, I draw on the literature, pilot test data, as well as my own educated guesses about potential responses to the research questions, which result in the various sub-categories (see the bulleted items in Table 2) under each of the categories. During the course of data collection and analysis, some of the sub-categories within each of the major categories are added and some are deleted.

The conceptual framework is being continually revised and refined. A complete list of the categories and sub-categories is included in Table 2.

Table 2: Conceptual Framework for the Study

1. Workplace Information Fluency Skills for Technical Communicators • Recognize information needs • Gather/acquire information • Interpret, organize, and communicate information • Synthesize information to form and promote best practices • Use information technologies
2. Instructor Perceptions and Attitudes • Familiarity • Importance
3. Current Implementation • Recognize information needs • Gather/acquire information • Interpret, organize, and communicate information • Synthesize information to form and promote best practices • Use information technologies • Associated topics
4. Barriers and Supports • Barriers • Supports

Summary of Literature Review

In this chapter, I reviewed literatures that discuss the three components of information fluency—information literacy, FITness, and critical thinking. This part of the review informed me that information fluency is a holistic competency and it is the result of the interplay of all three components; it is acquired through practice in knowledge or professional domains. In order to observe discussions on the appropriate ways to implement the workplace skills in academic programs, I also looked at literatures on the use of collaborative learning

pedagogy in technical communication. This part of the review revealed that classroom-workplace collaborations such as cases, client projects, service learning, and internship are potentially beneficial in immersing students in the professional communities and exposing them to the social and rhetorical contexts of the workplace.

In general, this chapter presented a critical review of literature pertinent to my study, as well as a conceptual framework for the design of the research instruments and interpretation outline. In the following chapter, I will present the methodologies I used to find out the workplace information fluency skills valued by employers and how they are perceived and taught in technical communication programs.

CHAPTER THREE: METHODOLOGY

The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators and how instructors perceive and teach these skills in the classroom, and to suggest how these findings can inform teaching practices in our profession. I believe a better understanding of these key skills and their places in the technical communication discipline would allow instructors and program administrators to proceed from a more informed perspective in terms of facilitating information fluency and preparing students to be successful professionals and independent thinkers.

In seeking to understand the relationship between information fluency and the technical communication curriculum, this study addresses four research questions:

1. What workplace information fluency skills are valued by employers of technical communicators in the current job market?

2. How do instructors of technical communication perceive information fluency?

3. How do instructors of technical communication teach skills related to information fluency in their classes?

4. What barriers exist in current technical communication curricula that will impede students' acquisition of information fluency skills, and what supports and resources are there to facilitate acquisition?

This chapter describes the study's research methodology and includes discussions around the following areas:

- Overview of Research Design
- Rationale for Research Methodology
- Description of the Research Sample
- Methods of Data Collection
- Analysis and Synthesis of Data
- Limitations of the Study

Overview of Research Design

The following list summarizes the 5 (five) steps I went through to carry out this research.

1. The **literature review**. Preceding the actual collection of data, I conducted a selected review of the relevant literature to study information fluency in terms of its three components. I also looked for the use of collaborative learning pedagogies in technical communication classrooms. This literature review laid the theoretical foundation and conceptual framework for answering my research questions.
2. The **content analysis**. I collected technical communication job recruitment postings from the Society of Technical Communication (STC)'s Technical Communication Career Center and Monster.com, from January to April 2009, as data for the content analysis. With the job posting data collected, I conducted a content analysis identifying specific information fluency skill requirements and preferences of employers. These specific skill requirements were then sorted under the categories and sub-categories of the conceptual framework. Then, I counted the instances of

3. The **Institutional Review Board (IRB) process**. I designed the survey questionnaire based on result of the content analysis, and then acquired approval from the IRB to proceed with the research. Because my study was determined to be minimal risk for human subjects, IRB approved a waiver of documentation of content for all subjects (see Notice of Exempt Review in Appendix H). Therefore, respondents to the survey did not need to sign consent forms before taking the survey.
4. The **pilot**. I piloted the survey with 4 technical communication faculty members in two U.S. universities; according to the pilot result and feedback, I revised the survey questionnaire.
5. The **online survey**. I administered the survey using online survey service Survey Monkey and distributed the survey request on the ATTW listserv at attw-l@lyris.ttu.edu. Forty-eight technical communication instructors responded to my request.

Rationale for Research Methodology

Within the framework of qualitative research methodology, this study employs a combination of qualitative and quantitative instruments for data collection. Cindy Johanek once said, "All research methods are limited in the kinds of questions they can answer and depend on the contexts in which those questions are asked; similarly, all research methods

have value within certain ranges of research contexts and questions" (27). This research is intended to explore perceptions of information fluency skills not only from the professional and employer's perspective, but also from the academe's point of view; not only do I intend to identify current trends in recruiting, but also research practices in teaching. In addition, the data I collect include quantitative data about the frequency each specific skill appeared in the job postings, as well as qualitative data about the attitudes, perceptions, and methods instructors hold toward teaching information fluency skills. Therefore, one single method alone could have been too limiting to serve the purpose of this study, and would not allow for gaining insights from people within both contexts and to answer the research questions. Therefore, I use two primary methods to include:

1. A **content analysis** on the most recent technical communication job recruitment postings, and
2. An **online survey** of technical communication instructors.

Both the content analysis and survey include qualitative as well quantitative elements. Quantitative approach is applied to "describe current conditions, investigate relationships, and study cause-effect phenomena" (Bloomberg and Volpe 8), they are most suited to explore the statistical significance of the information fluency skill sets and to study the current implementation status of information fluency in technical communication classrooms. Because qualitative approach "implies an emphasis on exploration, discovery, and description" (Bloomberg and Volpe 8), I use them to collect perceptual and descriptive data provided in the survey responses. Even though the data collection methods include both

qualitative and quantitative approaches, the overall methodology of this study is still guided by the principles and objectives of a qualitative research.

Besides the two primary methods, an ongoing selective review of literature is conducted to inform this study, in addition to the large-scale initial literature review. The focus of the overall review was to gain better understanding of what constitutes information fluency and how instructors can facilitate students to become fluent with workplace information skills while they are still attending school.

In the paragraphs that follow, I explain how these two methods together produce valid and reliable results that provide insights into perceptions of information fluency skills in the profession and in the discipline of technical communication.

Content Analysis

The first data-collection method is a content analysis. The purpose of the content analysis in this study is to answer my first research question: What workplace information fluency skills are valued by employers of technical communicators in the current job market?

To answer this question, I conduct a content analysis on the most recent job postings from the STC Technical Communication Career Center, located at http://jobs.stc.org/home/index.cfm?site_id=360, and from the Internet employment site Monster.com. As a form of qualitative research methodology, content analysis is open to disciplinary diversity and has different definitions to scholars in different fields. Using this method, the researcher can describe, interpret, and analyze written texts and spoken words to

reveal "a broader range of social practice that includes nonlinguistic and nonspecific instances of language" (Schiffrin, Tannen, & Hamilton 1).

The content analysis method fits well with answering the above-mentioned research question because it allows me to access a large sample of recruitment data without having to conduct direct observation on hiring activities. In reality, I cannot directly observe managers in their hiring of new technical communicators and cannot observe all technical communication graduates in their job seeking activities—both methods will potentially yield rich recruitment data. Therefore, I need to make inferences about the most current trend in skill and qualification requirements based on observing the most recent job postings. These postings are textual materials suited for such analysis because they "provide a window to current, employer-based needs for new or experienced technical communicators," according to Clinton Lanier (53).

The job recruitment postings are also believed to be a reliable source for analyzing trends and requirements in hiring because they are created carefully. This offers another advantage of using them as materials for analyzing. According to Lanier, within the human resources discipline, there is a large body of job analysis research dedicated to understanding the skills required for performing different jobs. Before the content of any job advertisement is created, the human resource department usually performs a job analysis in order to generate an accurate description of the job and the skills required. Therefore, as a data source, the job postings are relatively reliable.

> [O]ne can still assume that as a data source the information within those

> ads will not stray from the reliability created in previous studies. (Lanier 52)

Today, Internet employment sites are preferred by both employers and job seekers alike. Many employers prefer using Internet employment sites to post recruitment listings because they cost less than traditional paper-based advertisements and can reach a larger population. In 2002, 90% of Fortune 500 companies used Internet recruiting and, as a result, the expenses they spent on advertising positions dropped 20% compared to spending on newspaper and traditional forms of recruiting (Feldman and Klaas).

Therefore, the accessibility, low costs, and reliability make Internet job recruitment postings an ideal source for finding samples for the content analysis.

Survey

The second data-collection instrument is an online survey. According to Plumb and Spyridakis, survey research is "a powerful tool that can help technical communicators identify and elaborate on the theories and practices that define technical communication as a profession… It can tell us about the nature of our work and, if used properly, can even help change the way we train people to become technical communicators" (1). Carolyn Miller remarks that surveys can

> show what kinds of work-related writing the population surveyed does, how important it seems to be, what its common problems are, and what qualities and features are valued… Many surveys, such as those by Marcus Green and

> Timothy Nolan and by Bill Coggin, have been proffered as authoritative sources of information about what a curriculum should accomplish for its graduates. (16)

For this study, I design a survey that uses questionnaires to query instructors of technical communication on what they know about information fluency, how important they think information fluency is in relation to students' professional and academic success, how they teach the information fluency skills that employers believed to be critical, and what factors they perceive are impeding or can better facilitate students to learn workplace information fluency skills while they are still attending schools.

The purpose of conducting this survey is to answer the second, third, and fourth research questions: How do instructors of technical communication perceive information fluency? How do instructors of technical communication teach skills related to information fluency in their classes? What barriers exist in current technical communication curricula that will impede students' acquisition of information fluency skills, and what supports and resources are there to facilitate acquisition?

This method has a number of advantages in relation to the chosen research questions. First, a survey allows me to reach a large population of technical communication instructors. My survey aims at collecting information about technical communication instructors across the United States and identifying their perceptions of important information fluency skills. Because a survey is relatively inexpensive (especially when conducted via the Internet) and can be administered from remote locations, a large sample is feasible, making the results

statistically significant. The second reason for using a survey is that it allows the collection and analysis of both qualitative and quantitative data through asking two types of questions: "closed-response (questions that can be answered by selecting from among options)" questions and "open-response (questions that require the respondent to produce spoken or written answer)" questions (Brown 9). Closed-response questions provide me with quantitative data and open-response questions give me qualitative data.

Combining open and closed response questions also helps to increase validity of this study. The survey method is often challenged for its weak validity in the results. The relative lack of firmness in validity comes from the form itself. With multiple choice questions, the survey format tends to put a restraint on the possible responses it can collect, thus limits the validity of this approach. The instructors' perceptions of information fluency skills and their methods of teaching those skills are diverse and are hard to grasp in the available multiple choices provided by the questionnaire; and the provided choices are only approximate indicators of their perceptions and practices. To counteract the limitation and to increase the validity of the online survey results, I complement closed-response questions with open-response choices when collecting perceptual information. When answering questions with open-response options such as "if other, please specify," instructors have the opportunity to fill in the gaps between their real perception and the choices they are provided in the questionnaire. The combination of question types can significantly increase the validity of the study.

There is not much concern with reliability for using the survey method, because survey research "presents all subjects with a standardized stimulus, and so goes a long way toward eliminating unreliability in the researcher's observations" ("Reliability and Validity of Survey Research"). Therefore, to answer the pertinent research questions within the perimeter of this particular study, it is most practical to use the survey method.

Research Sample

In this section, I describe the research sample population and explain sampling strategy for both methods.

Content Analysis Sampling

I use a purposeful sampling procedure to select samples for the content analysis. Purposeful sampling is a method that is typical of qualitative research (Silverman). This method is the opposite of the random sampling procedures that characterize quantitative research, which is based on statistical probability. In quantitative research, the random sampling method "controls for selection bias and the objective is to enable generalization from the sample to a larger population" (Bloomberg and Volpe 69). However, social qualitative research is less concerned with controlling bias and focuses more on examining how a social phenomenon is experienced by the participants and observed by the researcher. Therefore, the objective of purposeful sampling is to yield insight and understanding of the phenomenon under investigation by selecting *information-rich cases*.

> What would be 'bias' in statistical sampling, and therefore a weakness, becomes the intended focus in qualitative sampling, and therefore a strength. The logic and power of purposeful sampling lie in selecting *information-rich cases* (emphasis added) for study in depth. (Patton 230)

The populations from which the job posting samples are drawn are the public job listings posted on the STC Technical Communication Career Center and Monster.com. I use the STC site as one of my sampling sources because it is the nation's largest professional association for technical communicators. The STC Website provides job postings that reflect the most typical hiring patterns and needs within the same time frame. I choose Monster.com as a second site for collecting samples because it is one of the most robust and popular Internet job sites in the United States, and performs the same functions as most other job search engines. I believe these two sites combined will provide me with the most representative and up-to-date job posting samples that will serve as my information-rich cases.

In addition, the following criteria are used to ensure information-rich cases are collected:

- **All samples must be posted between January 1 to April 30 of 2009.** Job postings are time-sensitive information resources. They reflect the hiring patterns and trends in an industry at a certain time and reveal the interests and forecast future development of a professional field. To ensure that my research samples reflect the most current trends during the time of the study, I include

- **All samples must have detailed statements on job responsibility and skill requirements.** Because purposeful sampling emphasizes selecting information-rich cases, I sample the job postings that had detailed job responsibility and skill requirements descriptions in order to ensure ample content for analysis. The final research sample includes 67 job advertisements.
- **All samples must be advertising for full-time positions.** I select only advertisements for full-time technical communicator positions, and exclude job postings for temporary, contactor, and part-time positions because they tend to reflect very different requirements from those of the full-time positions. For example, contractors are usually brought in to do a temporary project that requires skills the employer's team does not possess, or to work on a project for which the company does not have enough people to handle. Temporary and part-time positions tend to be project-specific and ask for adept and seasoned candidates. They emphasize finding candidates who possess cutting edge skills and long experience that are usually not realistic for newly graduated college and university students. Full-time staff employment, on the other hand, focuses more on the long-term relationship building between the employee and the

- **All samples must be advertising a position physically located in North America.** The job postings included in the content analysis are mainly jobs located in the United States. However, I also include jobs in Canada because both countries not only speak the same language, but share similar business culture and professional practices. This sampling strategy not only increases the number of samples that I can analyze, it also removes the concern for cultural differences in hiring and in job requirements that might occur if job postings in more different cultures were included.
- **All samples must be advertising for "technical communicator," "technical writer/editor," or equivalent positions.** On the STC site, the job postings are listed chronologically and I do not need to perform a search to select the samples. Monster.com generates job postings through the search engine, so I use the key words "technical communicator" and "technical writer" to search for job postings using the search engine imbedded in Monster.com. While most results fit the key words, some very close positions also emerge, such as "business proposal writer," "information designer," and "proposal manager." I also include these results because the job descriptions and functions are very similar to those advertised for technical communicators.

Survey Sampling

The target population for the online survey is all technical communication instructors across the United States. The survey uses judgment sampling. Judgment sampling is a common non-probability method and an extension of convenience sampling. According to Patton, judgment sampling is another name for purposeful sampling and is another strategy for selecting information-rich cases. With judgment sampling, the researcher chooses a group of samples that could reasonably be expected to have expert knowledge of the subject being investigated and could perhaps be able to provide valuable data or information to the researcher. This sampling method is used when a limited number or category of people are known to have the information that is sought.

Using judgment sampling, I draw my entire sample from one "representative" organization—Association of Teachers of Technical Writing (ATTW). Formed in 1973, ATTW is now the most well-known organizations of technical communication instructors in the United States. It has "approximately 1,000 members and includes both graduate and undergraduate students of technical communication as well as professional technical communicators in business and industry" ("History"). It is also home of the prestigious academic journal Technical Communication Quarterly, which stays on the top in encouraging "dialogue among teachers of technical communication" and developing "technical communication as an academic discipline" ("History"). Because of its history and wide influence, I am confident that members of ATTW are *representative* of the characteristics of the population this survey is targeted. Therefore, the chosen sample is truly representative of

the entire instructor population in the United States. The invitation to participate in the online survey is distributed on the ATTW e-mail listserv. There are a total number of 48 instructors participate in the survey.

Data-Collection Methods

This study employs two different data-collection methods, a content analysis and a survey.

Phase I: Content Analysis

As discussed earlier, the purpose of the content analysis is to answer the following research question: What workplace information fluency skills are valued by employers of technical communicators in the current job market? To answer this question, I sample 67 job postings that were available from the STC Career Center and Monster.com from January 1 to April 30, 2009 (see Appendix B: List of Analyzed Job Recruitment Postings). To assess and organize the job postings in a systematic fashion, I employ the first category of the conceptual framework, "Workplace Information Fluency Skills for Technical Communicators," and its 5 sub-categories:

1. Workplace Information Fluency Skills for Technical Communicators
    - Recognize information needs
    - Gather/acquire information
    - Interpret, organize, and communicate information

- Synthesize information to form and promote best practices
- Use information technologies

In the selected job postings, I look in the sections that have the headings indicating job responsibilities, job description, and skills/qualifications. While reading the job postings, I coded the content that implies the specific skills mentioned in the sub-categories. For example, when the job posting says "Reads journals, reports, and other material to become familiar with product technologies and production methods," I classify it as a specific skill under the sub-category of Gather/Acquire Information. The process is not totally linear as it might seem. Sometimes I find myself pondering on a skill statement and choosing whether it belonged to sub-category A or B. But generally, the process is efficient and effective and I am able to identify the specific workplace information fluency skills that the employer required in the selected advertisements for technical communicators.

Once the specific skills are identified and assigned under corresponding sub-categories, I collected numeric and quantitative values of the skills under each sub-category. I counted the instances each skill category was mentioned in the samples to determine the weight employers put on each skill. Next, I prioritized the skills based on the number of instances. I assume that the category that is mentioned in the greatest number of instances should be given the most attention. Some questions in the survey questionnaire were based on results of the content analysis.

Phase II: Online Survey

The survey was distributed among technical communication instructors through the ATTW listserv. It was open from May 21 to June 19, 2009. I used the online survey service, SurveyMonkey (located at http://www.surveymonkey.com/), to create and administer the survey (see Appendix C: Online Survey for Instructors). The survey was anonymous and required around 10 minutes to complete.

The survey design is divided into four sections that targeted various aspects of instructors' understanding and approach to information fluency. The first part of the survey collects demographic information about participants and their general understanding of information fluency. The next section examines whether the respondents are teaching the workplace information fluency skills identified in the job postings. It also seeks to find out other information fluency skills the respondents are teaching but are not included in the questionnaire. The next part of the survey asks the instructors' attitude and practices in teaching software application tools, and how they keep their students up to date about the advances in technologies. The last section examines their perception of the factors that could contribute to better preparing students to be familiar with workplace information fluency during their schooling.

Methods of Data Analysis and Synthesis

The process of data analysis begins with managing, organizing, and analyzing the collected data in presenting the major findings. I present the findings of this study in Chapter

Four in two steps. First, I list the findings of the content analysis and the online survey respectively. Because each of the data-collection methods generated a number of findings, and are supported with statistics, I feel it is necessary to present them fully. Both data-collection methods generated qualitative and quantitative data, which I combine and translate into finding statements. The finding statements are organized according to the categories of the conceptual framework. The finding statements for both methods also serve as the detailed material from which I draw the synthesized key findings for the study. After presenting findings from each data-collection method, I synthesize the two sets of finding statements into four key findings that serve to answer the four research questions of this study.

In Chapter Five, I develop an understanding of what lies beneath the data and findings. Whereas the findings chapter split apart pieces and chunks of data to describe the findings separately, this chapter is an attempt to reconstruct an understanding and interpretation of those findings. In presenting my analysis, interpretations, and synthesis of the findings, I organize the interpretation of findings into the following analytical categories:

1. Information fluency and workplace demand for technical communicators. (*Research Question 1*)
2. Instructors' attitude and approach to information fluency. (*Research Questions 2 and 3*)
3. Supports and barriers influencing students' acquisition of information fluency in technical communication programs. (*Research Question 4*)

The analytic categories are directly aligned with the study's research questions and the conceptual framework. Through analyzing and synthesizing data, I am also able to re-examine my original assumptions, which were identified in the first chapter.

Limitations of the Study

This study has certain limitations, some of which are related to the common critiques of qualitative research methodology in general and some of which are inherent in this particular study's research design. I have given careful thought to account for these limitations and to find ways to minimize their impact.

One of the key limitations of this study lies in the possible deviation of the job posting samples. Discourses and texts form and are formed by their contexts—the economic and political situations, language, media, and other discourses (Johnstone 9). The discourses of job advertisements are not isolated from these contexts. There are extra-linguistic factors that had shaped the content of the job postings, and during the time of my study, the economic downturn in the United States played a big role in shaping the job posting samples. The worldwide economic slow-down may have influenced and skewed my samples in various ways, in all likelihood. Therefore, I expect a certain amount of deviation from the usual composition of this sample population.

As a consequence of the drastic economic downturn, fewer-than-normal numbers of companies were actively hiring. And for those who were hiring during this time period, they were more likely than normal to prefer hiring those with some significant experience already,

because with entry-level new hires there is sometimes a lengthy and costly period of training, maturation, and adaptation to the culture of the business world that prevents them from being maximally productive from the first day on the job. On the other hand, more experienced hires are maximally productive immediately. For example, some job postings among the samples I collected require the candidates to demonstrate "experience conducting original research and analysis" (Jeppesen), to show "initiative in developing expertise on new information delivery methods and technologies"(Websense), to "provide oversight and interact closely with other staff in the preparation and production of a variety of documents", or to "coordinate large production efforts"(Alion Science and Technology). Theses requirements are usually asked for in senior-level positions. With this deviation being recognized and given the reality of the situation, I did not expect to be able to change such economic circumstances but to work with it.

Another limitation lies in the possible subjectivity when I identified information fluency skill categories and sub-categories during the literature review. The conceptual framework is based mostly on my personal reading of the literature, my experience, and my educated guesses. Some level of subjectivity will unwittingly exist. In order to avoid distortions in data collection and representation due to researcher subjectivity, a common practice in social research is to use a co-researcher or co-coder and to conduct inter-coder reliability analysis (Titscher et al. 65). However, for my dissertation, I do not conduct a reliability analysis for two reasons. The first reason is that it is not realistic to recruit a co-researcher to assist my dissertation work. Second, I do not set a goal to quantify the skills revealed in the contents of

the job postings with precision. Because the study is ultimately qualitative in nature, I aim to identify general tendencies that would help me look at the overall trends presented in the job requirements. At the same time, the techniques of data collection that I use for the content analysis are rather simple and can be replicated by any researcher at any time.

The second methodology—the survey—also contributes to counteracting the limitation of content analysis. Survey research presents high reliability and can reduce the subjectivity of the researcher. Because "[s]urvey research presents all subjects with a standardized stimulus, and so goes a long way toward eliminating unreliability in the researcher's observations" ("Reliability and Validity of Survey Research"), I am confident that my own bias and subjectivity are kept to a minimum level in conducting the study.

Conclusion

This chapter provided a detailed description of this study's research methodology and offered rationales for why they suit the purpose of the study. I employ two data-collection methods, including a content analysis and an online survey. On the whole, the chosen methodologies complement each other. The selection of methods is governed by their suitability for specific contexts and purposes. The content analysis helps me to understand what new hiring trends existed among employers. The online survey complements the content analysis and is chosen because it can reach more participants and investigate perceptions of instructors. The intent is that this study will make a contribution to the understanding of important workplace information fluency skills in the context of technical

communication. Additionally, I hope that this study will be of value to administrators, instructors, as well as students of undergraduate technical communication programs.

The next chapter, Chapter Four, describes the results of the content analysis and the survey. It will also present the four key findings of the study.

CHAPTER FOUR: PRESENTATION OF FINDINGS

The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators and how instructors perceive and teach these skills in the classroom, and to suggest how these findings can inform teaching practices in our profession. I believe a better understanding of these key skills and their places in the technical communication discipline would allow teachers and program administrators to proceed from a more informed perspective in terms of facilitating information fluency and preparing our students to be successful professionals and independent thinkers.

This chapter begins with presenting findings obtained from the two data-collection methods—a content analysis of 67 job postings, as well as an online survey of technical communication instructors. Because each of the data collection methods generated a number of findings, and the findings are supported with statistics, I feel it is necessary to present them fully to show the basis from which I draw the synthesized key findings for the entire study. After presenting the findings from each data-collection instrument, I will also present the four synthesized key findings of this study.

The qualitative data I collected for this study include notes from job recruitment postings and survey comments. The data collection methods also generated quantitative data yielding numbers, frequencies, and percentages. I will call both the qualitative and quantitative data as "raw data." The raw data are organized according to the categories of the conceptual framework. I transfer these raw data into finding statements. These finding

statements, along with the data, serve as the detailed material from which I draw the synthesized key findings of this study. To manage data collected from the content analysis, I create data summary tables (Appendix D) to compile what the job postings have said about the specific skills under each of the conceptual framework categories and to record the number of counts for each skill. For the data collected from the survey, I use the survey summary tables that were automatically generated and provided by the online survey service provider, Survey Monkey. At this stage, I give no interpretations to the findings.

After the findings of the content analysis and survey are presented, I synthesize these two sets of finding statements into *four key findings* that serve to answer the four research questions set out in Chapter One. The synthesizing process involves some researcher interpretation.

The four key findings emerged from this study are as follows.

1. Employers value technical communicators who know what information they need to do their job, who are competent in finding, evaluating, and using information, and who know how to use specified tools to gather and communicate information effectively, efficiently, and ethically.
2. Instructors of technical communication are not familiar with the concept of information fluency, but they think the competencies and skills that constitute information fluency are extremely important in students' potential success in the workplace.

3. Instructors of technical communication are implementing most of the employer-valued workplace information fluency skills in their technical communication/writing courses; and most of the skills are taught in association with reports and proposals.
4. Most instructors think that students can better learn work-related skills through internships.

Following are discussions of the findings from each data-collection method with details that support and explain each finding. The findings are presented here with no researcher interpretation.

Findings from the Content Analysis (CA)

The ordering of the CA findings is based on the first conceptual framework category, "Workplace Information Fluency Skills for Technical Communicators." Under this category, there are five sub-categories each presenting a type of information fluency skill the employers may require. Figure 5 shows each of the five sub-categories and their percentages appeared in the job posting samples. The five sub-categories are:

Category 1: Workplace Information Fluency Skills for Technical Communicators

- Recognize information needs
- Gather/acquire information
- Interpret, organize, and communicate information
- Synthesize information to form and promote best practices
- Use information technologies

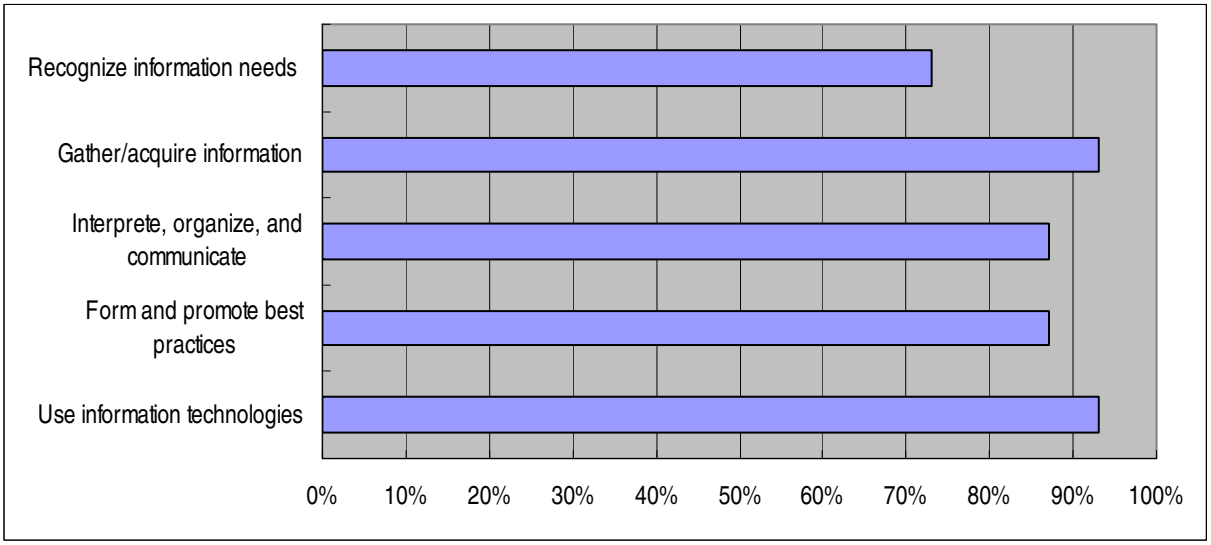


Figure 5: Employer-valued Information Fluency Skills for Technical Communicators (Results from the CA)

Following is a discussion of the findings from the content analysis with details that support and explain each finding.

CA Finding 1: The majority (49 of 67 [73%]) of job postings indicate that employers require technical communicator candidates to have the ability to recognize information needs in their work.

The first finding from the CA tells me that employers strongly recommend their technical communicator candidates to be capable of recognizing when and what information is needed in order to successfully complete their work. This involves interpreting project plans and strategies and translating them into concrete information needs. There are different kinds of information a technical communicator may encounter, and here, information refers to those acquired through analyzing project and/or audience needs to determine materials required, organization, content, format, and applicability of documentation.

Through careful reading of the job recruitment posting samples, I find the specific skills that employers look for in recognizing information needs include the following.

- **Analyzing project** (36 [54%]). Recognizing information needs for a project involves knowing the goals and objectives of the project, and analyzing the scope and requirement of documentation. Being able to analyze a project also involves determining types of publications/documentation needed. The methods to understanding project requirements include studying product and requirements, conferring with developers, and talking to end users.
- **Analyzing audience** (28 [42%]). The audiences here include users as well as the clients. That is to say, not only are technical communicators required to be able to "understand documentation requirements by conferring with end users," they should also have the ability to "research and plan documentation requirements for new products based on client requirements."

CA Finding 2: The overwhelming majority (62 of 67 [93%]) of job postings indicate that employers require technical communicator candidates to be able to independently gather and acquire needed information.

The ability to acquire and gather information independently is the most frequently mentioned requirement in the job posting samples I examined. Through careful reading of the job postings, I find the specific job functions that represent this competence include gathering information through interviewing (interaction with people) and studying existing documents and products (interaction with materials).

- **Interviewing** (47 [70%]). Interviewing skill is required of all levels of technical communication positions—from entry to senior levels. There may be a difference in degrees to which this skill is required, but the candidates are expected to more or less show their competency in gather and acquiring information independently. The qualified technical communicator candidates should have the skills in interviewing a variety of people to obtain important information in support of projects. These people include technical personnel, subject matter experts (SMEs), managerial personnel, compliance and standard assurance personnel, clients, and end users.
- **Studying existing documents and products** (38 [57%]). Studying exiting documents and products include reading blueprints, specifications, drawings, and product samples, and observing production procedure and developmental activities. A competitive technical communicator candidate should be able to extrapolate detailed information from studying these existing materials.

CA Finding 3: The majority (58 of 67 [87%]) of job postings indicate that employers require technical communicator candidates to have the ability to interpret and organize information, and effectively communicate information to a variety of audiences.

The content analysis also reveals that employers want their technical communicators to have the ability to "process" information by interpreting and organizing, and then communicate appropriate information to different audiences. Through careful reading of the job postings, I identify the following specific skills that entail this ability.

- **Creating documents according to corporate/industrial standards and compliances** (32 [48%]). A number of job postings specifically state that the technical communicator candidate should be able to create documents to comply with company standards. There are also times when a technical communicator needs to create documentation that must comply with industrial or governmental standards. For example, software and IT companies tend to require that the technical communicator be familiar with the Agile Standard—industry standard of SDLC (Software Development Life Cycle).
- **Converting technical information to easy-to-understand user documentation** (28 [42%]). Converting technical information to user documentation is one of the most basic requirements for any technical communicator, and it is no surprise that some of the samples also state it. Writing easy-to-understand documentation not only includes using the appropriate language, but also includes "analyze, interpret, and convert highly technical data to a *format* that non-technical personnel will understand."
- **Creating and formatting visuals to illustrate key points in document** (22 [33%]). Complex information is usually easier to understand when illustrated with visuals or presented completely in easy-to-understand graphics. The visuals elements technical communicators work with most include process flowchart, workflow diagram, and photographs. Some of the samples state that the candidates should be able to "incorporate digital audio-visual elements into documents to enhance value as

educational and reference materials," to create "original graphics and/or import drawings, photos and figures to illustrate product use," or have the ability to "create detailed data flow diagrams and graphics." So, as communication specialist for the organization, technical communicators are also expected to make things easier for their audience by using visuals, and help them focus on the important and most relevant information.

CA Finding 4: The majority (58 of 67 [87%]) of job postings indicate that employers require technical communicator candidates to have the ability to synthesize information and to form and promote best practices in their work.

Technical communicators have much room for creativity in their jobs. The creativity at work involves thinking and interacting with available information sources to solve on-the-job problems and to promote best practices. The specific job functions/skills that entail this requirement are planning project and providing estimates of time and resources, evaluating and testing documentation to ensure accuracy and ease of use, developing and maintaining templates, documentation guidelines and standards, and organizing and updating knowledge base/documentation repository.

- **Planning project and providing estimates of time and resources** (29 [43%]). The key to a successful project is in planning. Creating a project plan is the first thing when undertaking any kind of project. Today, more employers are realizing the value of a project plan in saving time, money, and many problems. Some require that the

technical communicator being not only able to manage the time and resources for a single project, but also to manage multiple projects across multiple teams.

- **Evaluating and testing documentation to ensure accuracy and ease of use** (27 [40%]). A sound document development process should include rigorous evaluation and testing of the documentation. Technical communicators should be able to conduct or participate in documentation or product evaluations at various stages. Some job advertisements even recommend technical communicators to be able to "develop evaluation and testing instruments."
- **Developing and maintaining templates, documentation guidelines and standards** (25 [37%]). Most senior-level positions require this set of skills by stating that the candidates should be able to "develop templates for new and existing projects and products," "develop standard documentation templates as needed," or be "knowledgeable in using multiple documentation tools to develop base templates and manipulate output styles."
- **Organizing and updating knowledge base/documentation repository** (20 [29%]). Using knowledge base/documentation repository is an effective knowledge management approach that many organizations and companies use today. Technical communicators are also required to be familiar with these tools.

CA Finding 5: The overwhelming majority (62 of 67 [93%]) of job postings indicate that employers require technical communicator candidates to understand new technology and have working knowledge of popular software tools for the profession.

The common belief in the academe is that too much emphasis on the software skills will do our students disservice as that will possible introduce them to a narrow-focused "tool-jockey" point of view. Unlike this common belief, the content analysis reveals that employers do value technical communicators who can use specific tools. Some indicate they strongly recommend technical communicators to have "up-to-date knowledge about advances in technology." (14 [21%]), and look for skills in using the following tools (Figure 6).

- Microsoft Office Suite (34 [51%])
- Content/Knowledge Management (25 [37%])
- Graphic Design & Illustration (e.g., Adobe Illustrator, Photoshop) (24 [36%])
- Web Markup Languages (e.g., HTML) (22 [33%])
- Help Authoring Tools (e.g., RoboHelp, MadCap) (14 [21%])
- Desktop Publishing (e.g., FrameMaker, Inmedius S1000D Suite) (14 [21%])

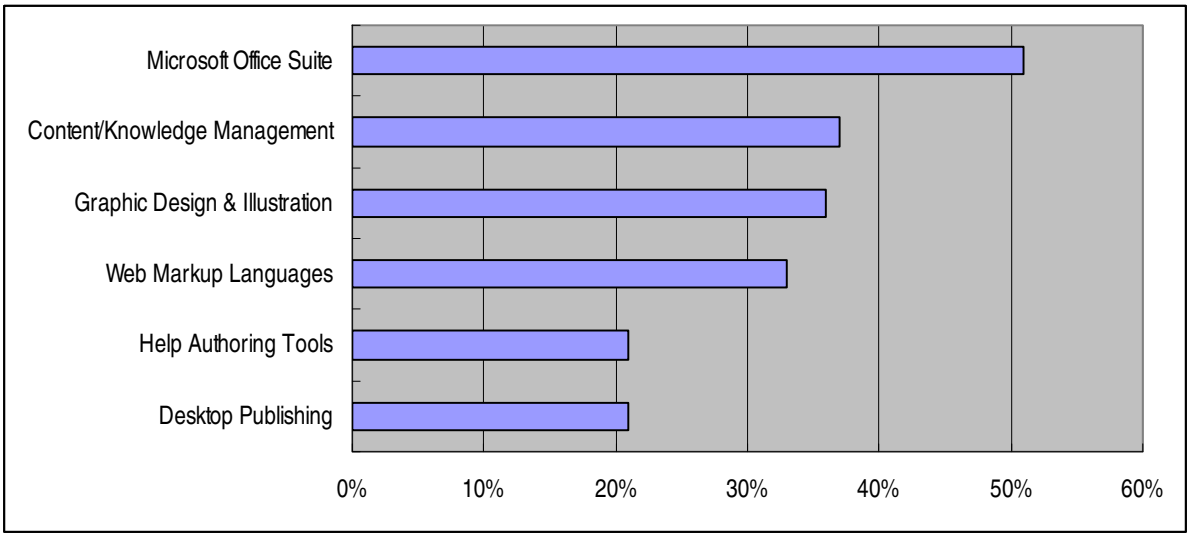


Figure 6: Employer Requirements on Software Application Skills

As mentioned earlier, the ordering of the findings is based on the first category of the conceptual framework—"Workplace Information Fluency Skills for Technical Communicators," and not according to the percentage rating. In order to visualize the statistical relationship between the specific skills found in CA (excluding the software application skills), here I present a chart (Figure 7) to help us see the statistical relationship between each specific skill.

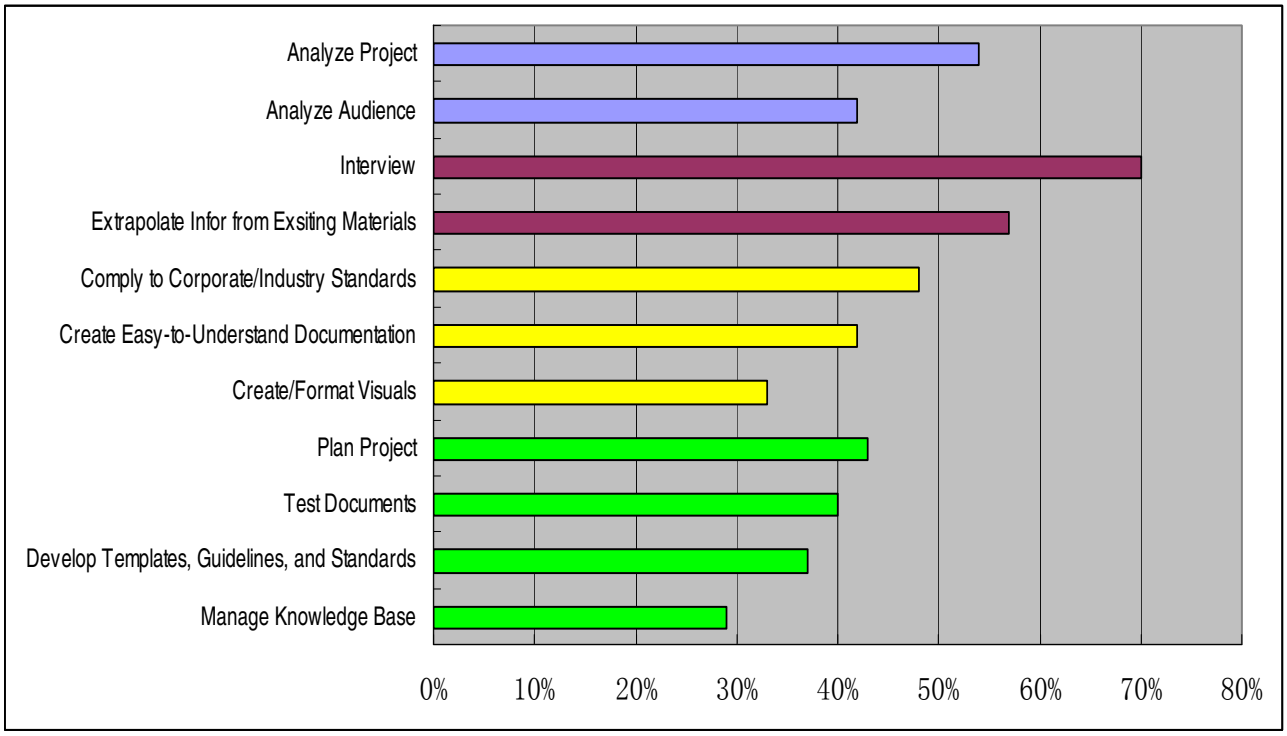


Figure 7: Specific Skills Entailed in CA Findings 1 to 4

Naturally there are all sorts of other expectations or preferences the employers might also have for technical communicator candidates, but given the limited amount of space of their advertisements, they have to highlight the factors that are most important to them. Also, the content analysis only focused on discovering the requirements that reflect the ability to

work with information. So, the findings for the content analysis should be only considered the requirement of *information fluency skills*, rather than as comprehensive skill requirements for such a position.

Findings from the Survey

The purpose of conducting the survey is to collect instructors' understanding of information fluency and to find out whether they incorporate the employer-valued workplace information fluency skills in their teaching; and if they do, in association with what topics or assignments are they teaching these skills.

The survey is designed to allow respondents to skip any question or quit at any time. Because of this feature, even though there are a total number of 48 respondents who participated in the survey, not all of them answered all questions. This presents a challenge in presenting findings because the uncertain number of responses to each question (some questions have 45 answers, some have 47, and some have 48) makes it difficult to calculate the percentages. In order to make the calculation consistent throughout the analysis, I decided to assign a new choice to all questions in the post-survey calculation stage. The choice I added is "Unknown." Therefore, for the skipped questions, I assume the respondents chose "Unknown" for that question. This way, the total number of respondents for each survey question is always 48 and this ensures that I have a consistent base to calculate the percentages in the answers.

The survey findings are organized according the second and third categories of the conceptual framework, "Instructor Perceptions and Attitudes" and "Current Implementation." Each of these categories also has sub-categories:

Category 2: Instructor Perceptions and Attitudes

- Familiarity
- Importance

Category 3: Current Implementation

- Recognize information needs
- Gather/acquire information
- Interpret, organize, and communicate information
- Synthesize information to form and promote best practices
- Use information technologies
- Associated topics

Following is a discussion of the findings from the survey with details that support and explain each finding.

Survey Finding 1: A majority of survey respondents (36 of 48 [75%]) indicate they are not familiar with the concept of information fluency.

When asked about their familiarity with information fluency, only 8% percent of the instructors (4 of 48) responded they do research on it, and only 4% (2 of 48) have read 3 or more books or articles on the topic. The majority (36 of 48 [75%]) expressed that they either never heard about the term or have heard about it but are not familiar with the concept

(Figure 8). Even though the respondents' answers to the subsequent questions reflect that they do incorporate information fluency activities in their teaching, the answers to the question "Your Knowledge of Information Fluency" indicate that information fluency is a very unfamiliar term to most technical writing/communication instructors. Instructors are not aware that some of their class activities are contributing to students' information fluency building.

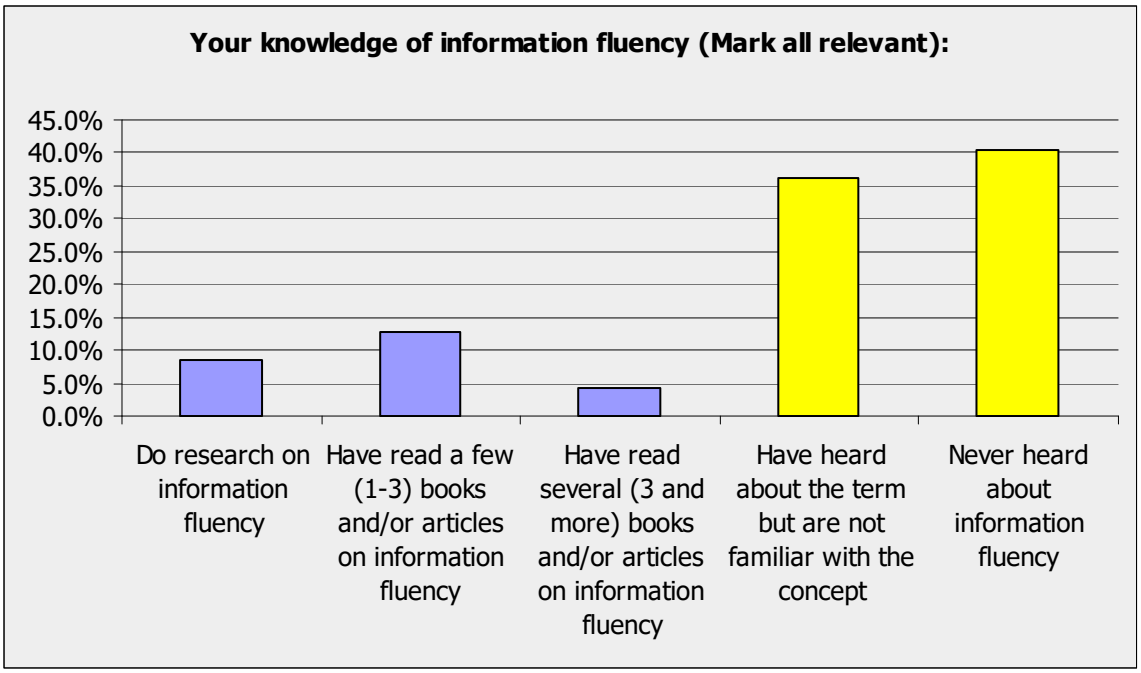


Figure 8: Instructors' Unfamiliarity with Information Fluency
(Yellow bars indicate survey respondents who are not familiar with information fluency)

Survey Finding 2: An overwhelming majority of respondents (44 of 48 [92%]) indicate they include activities in recognizing information needs in their teaching.

Helping students to recognize information needs for a writing project is a highly important and the most frequently implemented activity in the respondents' classes. The skills in recognizing information needs include audience analysis and project analysis.

- **Analyzing audience**. Audience analysis is highly regarded and widely implemented in the respondents' technical writing/communication courses. All respondents (48 of 48 [100%]) indicated they include audience analysis in their teaching. Some instructors indicate that audience analysis is part of almost everything they teach. "It is embedded in every assignment and technical communication topic I teach." Some look at audience analysis as part of the information design process, which the whole course was based upon.
- **Analyzing project.** 94% (45 of 48) of the respondents implement project analysis activities in their courses. The topics in which they incorporate project analysis spread among different assignment types. Among them the most prominent choices are reports (82.6%) and proposals (80.4%).

Survey Finding 3: An overwhelming majority of respondents (44 of 48 [92%]) indicate they include information gathering as part of their courses.

This finding is corresponding to the CA finding 3. From both findings we can see that information gathering skills are considered one of the most important skills in both the university and the workplace. Among the different topics and assignments, reports (86.7%) and proposals (88.9%) still are the assignments that are most frequently associated with this activity.

Survey Finding 4: An overwhelming majority of respondents (44 of 48 [92%]) indicate they include documentation activities in their classes to help student interpret and organize information, and communicate existing information to various audiences.

Instructors implement the task of interpreting, organizing and communicating information in almost all major assignments of a semester. The assignments associated with this topic spread among major ones include reports (40 of 48 [%]), instructions (39 of 48 [%]), job application materials (37 of 48 [%]), proposals (37 of 48 [%]), visual design (37 of 48 [%]), and workplace correspondence (30 of 48 [%]).

Survey Finding 5: An overwhelming majority of respondents (45 of 48 [94%]) indicate that they include activities in their classes that require students to analyze and synthesize information to create best practices.

When asked whether they incorporate activities that will help students analyze and synthesize information to create best practices, 39 respondents (81%) chose "testing documents for usability" and 36 (75%) chose "planning project." About half (23 (48%) included "developing documentation guidelines and standards, 15 (31%) chose "developing documentation templates;" and only 9 (19%) chose "creating and maintaining document repository" (Figure 9).

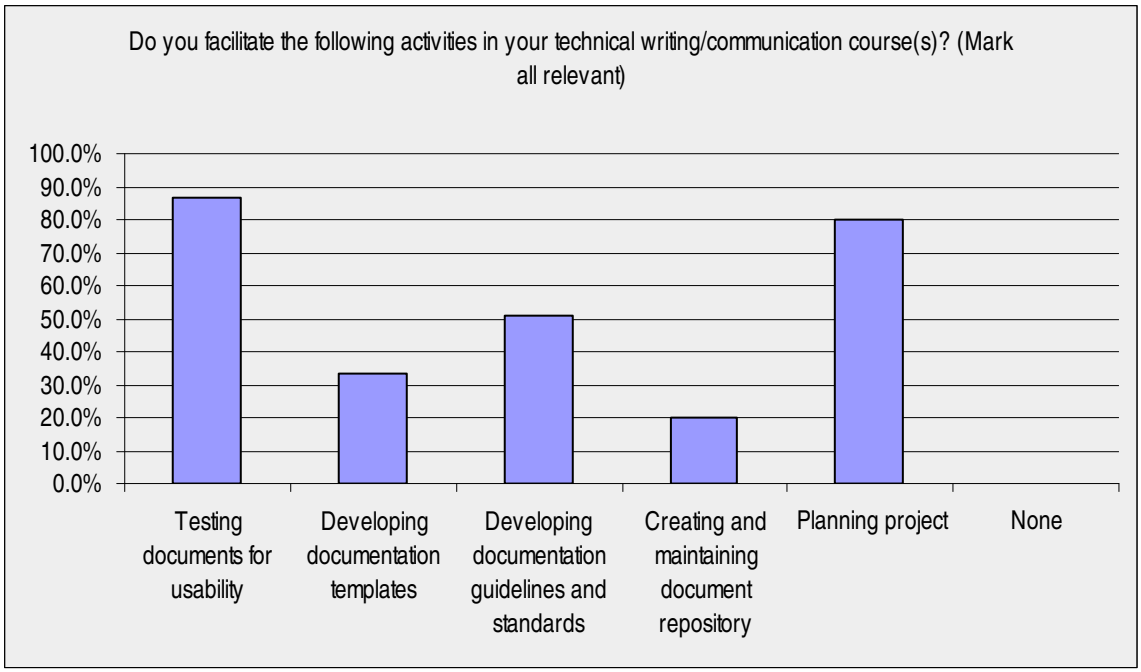


Figure 9: Working with Information to form Best Practices

Survey Finding 6: A majority of respondents indicate that instructors think information fluency is extremely important in students' potential success in the workplace.

Even though as revealed earlier that most respondents are not familiar with the concept of information fluency, when asked to rate the importance of each of information fluency's components in relation to students' potential success in the workplace, 71% of all answers to this question (67 of 94 answers) reflected positively and chose "Extremely Important" for that questions (Table 3). Only 1 answer reflected "Not Important," and two chose "Doesn't Matter Much."

Table 3: Responses to the question "In your opinion, how helpful are the following competencies in a student's success in the workplace?"

Answer Options	Extremely important	Important	Doesn't matter much	Not important	Response Count
Being able to recognize information needs	21	4	0	0	25
Being able to gather and evaluate information	16	4	1	0	21
Being able to apply information to solve problems	20	5	0	0	25
Being able to manipulate information technology	10	11	1	1	23

Survey Finding 7: A majority of respondents (38 of 48 [79%]) indicate they believe internship is an effective way to help students learn practical workplace skills.

When asked what factors may help students gain more practical workplace skills in the program, the respondents' answers vary. But the majority of them agree that internship is a good approach to equip students with these practical knowledge and other skills the academic program cannot fully provide (Figure 10).

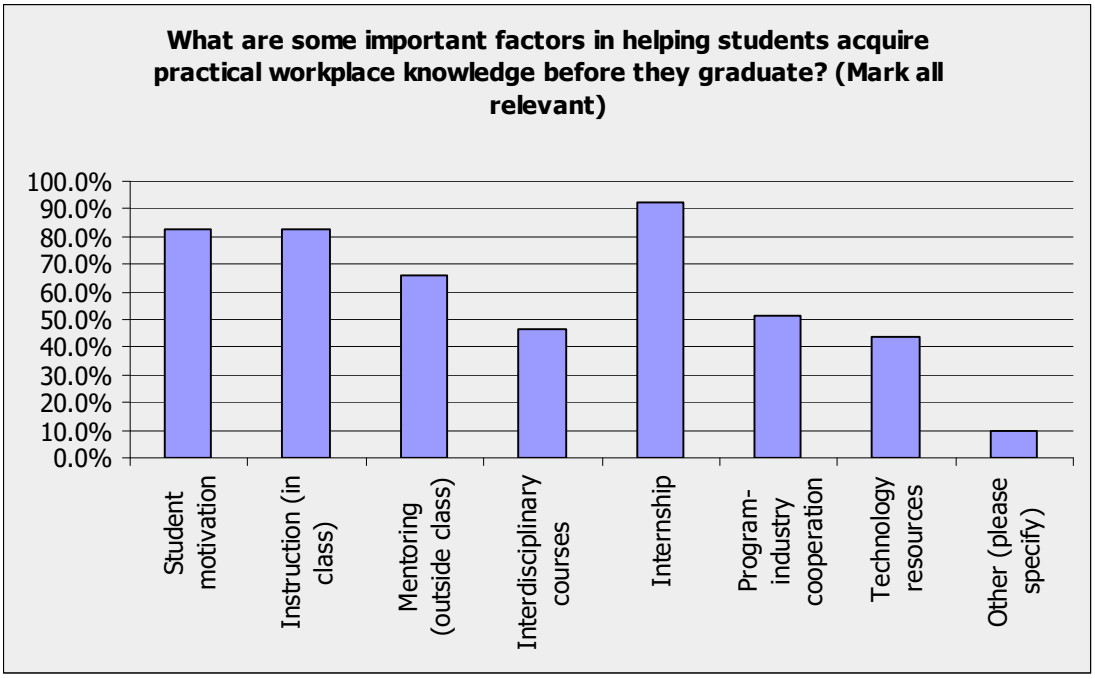


Figure 10: Helpful Factors for Students' Acquisition of Workplace Skills

Synthesized Key Findings

The findings from both data-collection methods are supported by statistics. However, the overall intent of including the numbers is not to quantify the data, or as a result, to quantify the study. Rather, the frequencies and percentages are supplemental to the explanations of the phenomenon behind them. In other words, the numbers are not as important as the findings and explanations that are suggested by them.

The findings from each method provide a rich pool of information from which I can draw answers to each of the four research questions raised in Chapter One. Because I should have one finding for each research question, I need to synthesize the various findings collected by each method (5 findings from the CA and 7 from the survey), and discuss the

research questions one by one. Therefore, I provide a list of synthesized key findings of this study. The four key findings are listed below.

Key Finding 1: Employers value technical communicators who know what information they need to do their job, who are competent in finding, evaluating, and using information, and who know how to use specified tools to gather and communicate information effectively, efficiently, and ethically.

After synthesizing the five findings from the CA, I found that the job posting samples require candidates of technical communicator positions to have skills that encompass all three components of our definition of information fluency. The information-related qualification requirements can be summarized in the following five categories (also see Appendix F: Detailed List of Employer-Valued Workplace Information Fluency Skills).

1. Recognize information needs
    - Analyzing project
    - Analyzing audience
2. Gather/acquire information
    - Interviewing technical and managerial professionals
    - Studying products and procedures
    - Studying blueprint specifications and drawings
    - Studying existing documents
3. Interpret, organize, and communicate information
    - Creating and formatting visuals to illustrate key points in document

- Converting technical information to easy-to-understand user documentation
- Creating documents according to corporate/industrial standards and compliances

4. Synthesize information to form and promote best practices
    - Evaluating and testing documentation to ensure accuracy and ease of use
    - Developing and maintaining templates, documentation guidelines and standards
    - Organizing and updating knowledge base/documentation repository
    - Planning project and providing estimates of time and resources
5. Use information technologies
    - Microsoft Office Suite
    - Desktop Publishing
    - Content/Knowledge Management
    - Graphic Design & Illustration
    - Help Authoring Tools
    - Web Markup Languages
    - Having up-to-date knowledge about advances in technology

Key Finding 2: Instructors of technical communication are not familiar with the concept of information fluency, but they think the competencies and skills that constitute information fluency are extremely important in students' potential success in the workplace.

The survey reveals that the majority of respondents are not familiar with the concept of information fluency. However, when asked to rate the importance of each of the components of information fluency's relation to students' success in the workplace, most of them rated the components as extremely important.

Key Finding 3: Instructors of technical communication are implementing most of the employer-valued workplace information fluency skills in their technical communication/writing courses; and most of the skills are taught in association with reports and proposals.

When asked whether they have implemented each of the employer-valued information fluency skills in their teaching, the instructors' responses are mostly positive. Even though most of them are not familiar with the concept of information fluency, and unaware that they are teaching information fluency skills, they are actively implementing most information fluency skills in their teaching.

Key Finding 4: Most instructors think that students can better learn work-related skills through internships.

The study found that among many factors (student motivation, in-class instructions, mentoring, etc), instructors look at the opportunity of an internship to be the most beneficial for students to acquire practical workplace experiences and skills in dealing with information. This key finding is derived from Survey Finding 7. When asked what factors may help students gain more practical workplace skills in the program, the respondents' answers vary.

But the majority of then agree that internship is a good approach to equip students with these practical knowledge and other skills the academic program cannot fully provide.

Summary

This chapter presented the findings uncovered by each data-collection method—content analysis and survey. In order to tie the various findings from both methods together, it also presented the four synthesized key findings. The findings of each data collection method are organized according to the conceptual framework, and the key findings of the study are organized according to the four research questions.

The findings presented in this chapter are subject to no interpretations. What I have done was to transform the raw data into a format that will facilitate analysis and interpretation in the next chapter. Whereas I split apart pieces of data to describe the findings separately here, the next chapter will attempt to provide my understanding of what these findings mean, and to reconstruct a more holistic picture suggested by this study.

CHAPTER FIVE: ANALYSIS AND INTERPRETATION OF FINDINGS

The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators and how instructors perceive and teach these skills in the classroom, and to suggest how these findings can inform teaching practices in our profession. The previous chapter presented the findings of this study. In this chapter, I will provide interpretative insights into these findings. I will discuss what I think the findings mean and how we can relate what is found to the reality and the bigger social and economical contexts we are living in.

This study is based on the following four research questions:

1. What workplace information fluency skills do employers require when hiring technical communicators?
2. How do instructors of technical communication perceive information fluency?
3. How do instructors of technical communication teach skills related to information fluency in their classes?
4. What are the barriers that might inhibit technical communication programs implement information fluency and what kind of resources can we use to better facilitate information fluency among students?

These four research questions are largely satisfied by the findings presented in Chapter Four. The overriding finding in this study reveals that employers require technical communicators to have information skills that encompass all three aspects of the academic

definition of information fluency, and the specific skills entailed in these categories are highly regarded and are being taught by instructors, except for using specific software tools.

In order to analyze and interpret the findings in some sensible structure, I use another organizational device—analytic category—to organize the interpretations. The analytic categories build up a framework that allows me to structure my discussion logically. This chapter is organized into the following analytic categories:

1. Information fluency and workplace requirements for technical communicators. (*Research Question 1*)
2. Instructors' attitude and approach to information fluency. (*Research Questions 2 and 3*)
3. Supports and barriers influencing students' acquisition of information fluency in technical communication programs. (*Research Question 4*)

These analytic categories are directly aligned with the study's research questions and conceptual framework, which are used to code the data and present the findings in the previous chapter. In the analysis, I search connecting patterns between the findings and the social and economic context within which this study took place. I try to interpret each analytic category from different perspectives in order to explain what I think are possible causes and connections that lead us to discover what we have found. Whereas the findings chapter split apart pieces and chunks of data to describe the findings separately, this chapter attempts to reconstruct a big picture and answer the "why?" and "why not?" questions around the findings. The purpose is to present a holistic understanding on the issue of information

fluency and technical communication. This chapter also provides a reexamination of my research assumptions, which I presented in the first chapter. I will conclude this chapter with a summary that incorporates a note regarding the effect of possible researcher bias in interpreting the findings.

Analytic Category 1: Information Fluency and Workplace Requirements for Technical Communicators

The first research question seeks to understand employers' requirements on information skills when they are hiring technical communication practitioners. The data reveal that the skill requirements go far beyond what were believed to be the survival skills for the profession: writing and editing. The findings from the content analysis indicate that employers value technical communicators who know their information needs, who are competent in finding, evaluating, and using information, and who know how to use specified tools to gather and communicate information. These skill sets correspond to the three components of information fluency—information literacy, FITness, and critical thinking. This is a positive relationship, or an agreement, between the academic definition of information fluency and the practical demands from the workplace.

This agreement, however, does not imply that the industry and the academe have been collaborating on the matter of information fluency. Historically, there has been a continual tension between the industry and the academe as to what should be expected of graduates from college. The industry says what it wants and needs for its "workers," but the academy is

aimed at developing the full "person," who might have different jobs from time to time and who aims to advance in career to suit themselves rather than being only a skilled worker in the corporate world. Through studying the job recruitment samples, however, I find that the industry is looking for technical communicators who are well-rounded rather than just being specialized with certain mechanical skills. They require candidates to be good at their daily jobs, and also have the ability to think critically and be able to expand their current skill sets if needed. These requirements come closer to the academe's expectations of the college graduates. What makes such an agreement possible? What has changed about the industry that it is now favoring well-rounded professionals over skilled practitioners? In the following paragraphs, I will offer my interpretation of the changes in the workplace that might have caused such shift in hiring patterns.

The three interrelated explanations I am offering are "information responsibility," "adaptability to change," and "globalization."

Information Responsibility

The new economy requires that technical communicators must assume a great amount of information responsibility. According to Peter F. Drucker, the political economist and author, information responsibility refers to the willingness and ability to ask "What information do I need to do my job? From whom? In what form? When?" (46). Qualified technical communicators of the information age must be able to answer these questions themselves, as opposed to rely on others to identify the answers for them. In this sense,

technical communicators who assume information responsibility are very similar to what Patricia A. Carlson describes as the knowledge workers of the "information model" for business practices.

> Workers are encouraged to take on more responsibility in self-managing their tasks. Emphasis is on creative problem solving, mindful engagement in the task, and greater participation in decision-making. (78)

Focusing on developing information responsibility will not only benefit the technical communicators, but will also benefit the organizations. Drucker remarks that the new economy and the knowledge society require businesses to become information literate, and he suggests that the job of converting companies to information literate organizations will begin with the "new workforce" (252), by which he is referring to the individual knowledge workers. On the individual level, technical communicators are considered knowledge workers and professionals who are facing the demand to assume an increasing amount of information responsibility.

Information responsibilities held by individual technical communicators will also help the company reduce management costs and communication noise. Today's organizations are facing many new opportunities in rebuilding and restructuring their management structures. According to Drucker, today's multi-management levels in most organizations serve only to add noise to organizational information transfer. Each management-level added along the information channel serves to add noises. He explains this statement with the law of information theory. The first law of information theory says "every relay doubles the noise

and cuts the message in half" (Drucker 47), more management levels will neither manage people nor make decisions, but serve only as relays. During the course of organizational rebuilding, technical communicators who can function individually and effectively in new information and management structures become valuable and competitive.

Adaptability to Change

Aside from the strong urge to become information literate, today's organizations also face the challenge of fast-changing business environments, approaches, and the tools with which they produce services and products. Being information fluent is empowering to technical communicators in the changing organizations, because this competency helps them quickly adapt to the changes that their organizations must encounter.

Organizational researcher and author Thomas H. Davenport remarks that both information technology and innovative information use have huge potential in influencing the change of business processes.

> IT should explicitly be considered as a change lever or enabler of process innovation… But technologies alone cannot work miracles. Innovations in the use of computers and communications must be combined with innovations in how information is used and structured. (66)

The skills entailed in information fluency require a technical communicator to be strong in controlling information technologies (FITness) as well as using information in critical and innovative ways (information literacy and critical thinking). Therefore, the

information fluent technical communicator is capable of quickly adapt to any changes and innovations in business processes, technologies, or similar conditions as they take place.

So naturally, along with information responsibility, adaptability to change offers another explanation to why today's industry employers look for technical communicators who are considered information fluent.

Globalization

The third interpretation brings us to a global level. Current global deregulatory treaties, such as the General Agreement on Trade in Services (GATS) overseen by the World Trade Organization (WTO), is designed to "open global market by removing trade barriers for service industries around the world" (Starke-Meyerring 468). About half of the companies whose job recruitment postings I analyzed in the content analysis are in one way or another service-oriented. They offer services ranging from computer/IT, healthcare, retailing, to financial services. And there is little doubt that with the U.S. economy going global and with the enactment of GATS, they are more or less considering or are already establishing collaborations and business opportunities overseas. Even for those companies that are not service-oriented, going global is also likely a major topic in their business agenda. According to Dànielle DeVoss et al., by 2002 US investments overseas were worth over $300 billion, and one-third of US profits were earned in international trades.

Because of globalization, organizations have a number more challenges present to their technical communicators. Not only do they expect technical communicators to develop

information products for a global audience (which already includes a range of demanding responsibilities, such as accommodating language differences when writing and planning, internationalize content, and create modular content, etc.), they also require these professionals to have open and global collaboration strategies. The increasing complexity of working and communicating within and across corporate, cultural, and national boundaries means technical communicators will work in global virtual teams, communicate in centralized global networks, and use digital communication technologies frequently. As Doreen Starke-Meyerring puts it, "they work for or provide service to services to transnational corporations, work in global virtual teams, and communicate in global networks" (469).

Also, as the organizations' businesses are becoming more global, they will need to be more information-centered. Particularly, they must learn a lot more outside information than they are capable of now, because no one can compete or even operate in a global economy where one knows little about. With these changes going on, it is no surprise that the employers would require strong information skills from their technical communicators.

The analysis above intends to explain why employers look to hire technical communicators who are considered information fluent both in the academic and industry senses. However, requiring these competencies does not mean that employers look for the same quality and level in every technical communicator. Newly graduated technical communication majors may have the same skills, but master them on a different level than

the experienced ones. In reality, employers often realize the difference in levels when dealing with job candidates. They will not simply turn down a candidate only because his or her level of mastery in these areas are preliminary; rather, they may consider how they can use their existing levels of skills and provide professional development opportunities for the new graduates to mature in their professions.

The job postings I analyzed for this study, while seem to ask a lot of information fluency skills from the candidates, do reflect a special need occurring in a special economic situation. Thus, they present a slightly higher than normal demand in these skills. The hard economic situation and decreasing employment rate in the United States while the samples were collected reflect that employers require more capable professional. It should be taken into consideration, that while these requirements seem beyond the level of newly graduates, they are not the common trend and we should not be discouraged by them. As mentioned earlier, in a normal economic time, employers do differentiate between junior and senior skill levels and have different demands for them.

Analytic Category 2: Instructors' Attitude and Approach to Information Fluency

The study found that instructors of technical communication regard highly of the components of information fluency; they believe the skills that entail information fluency are extremely important in relation to students' potential success in the workplace. They are incorporating most of the employer-valued information fluency skills in their teaching, even though they are not explicitly aware of the term "information fluency."

To explain these findings, I would like to approach from two different perspectives and to talk about "information fluency as a new terminology" and "the changing nature of technical communication practice."

Information Fluency as a New Terminology

To most of the academic world outside of the library, the term "information fluency" is a rather new coinage. For years, activities around building and popularizing information fluency are mainly the concern of the academic libraries; and many major research and publications on this subject are done by librarians, not faculties. Because the library has a tradition of providing bibliographic instructions to all university students, it seems natural that it is still the center stage where information fluency initiatives are replacing the more narrow-focused bibliographic instructions. Recently, although many faculties are collaborating with the librarians to integrate information fluency instruction in specific curricula, it appears that this kind of cooperation is still rare in our discipline.

Therefore, for most instructors of technical communication, "information fluency" is a new terminology—something like a neologism. It is unlike the familiar concepts like visual rhetoric, content management, or information design that we can easily identify and share ideas about. Nevertheless, when the survey asked them not directly about information fluency, but to rate the importance of each component of information fluency, a majority of instructors indicated that those components are highly important in relation to student success. Judging from these findings, it appears somewhat clear to me that information fluency already existed

in the instructors' knowledge repertoire as something of significance, only they existed as disparate skill sets rather than a unified concept. In other words, our instructors already recognize the importance of information fluency but lack the terminology to speak of it simply.

In order to bring sharp focus to these diverse skills, we must promote information fluency among our faculties before we can introduce it to the students. The new term, "information fluency," therefore, might serve to give our instructors a "handle" on how to talk about and understand something they are already teaching but is too diverse to discuss as one concept. While the skills of information fluency vary, the use of this term allows us, as colleagues, practitioners, and professors in this field to speak about a whole collection of inter-related skills, attitudes, and perspectives in a single simple term.

However, this terminology is much more than just a convenient new notation system. It helps to weave the disparate elements of information fluency and brings it from a new term into "reality." It also helps faculty, students, and even employers to develop an awareness of the real intellectual and conceptual connection among these different factors or elements. The skills or techniques taught by the survey respondents (according to their answers to the survey) are all interconnected because they are all aspects of information fluency, working toward making students information fluent. They are like pieces of a puzzle, all fitting together to develop the full picture of the information fluent practitioner. As a result, our discussions about pedagogy and curriculum can be shifted away from niggling over details

such as particular software applications and instead shifted toward the big picture of information fluency.

The Changing Nature of Technical Communication Practice

The changing nature of technical communication practice can also explain why instructors are already teaching the interconnected information fluency skills, albeit not knowing about the term.

As revealed in the literature review, technical communicators are expanding their specialty areas. Michael Albers observes that there has been a change in employer's hiring over the past 10 years. Unlike the 1990's, when the ability to write was the critical standard for hiring, today's employers expect technical communicators to complement their writing ability with an expanded set of skills that depend on various aspects of technology. He suggested the technical communicators should expand their skills in four areas: "information architecture, information design, management, and human factors" (268). These new areas require them to be symbolic-analysts and to be good at working with information. The information fluency skills identified in this study such as document design, usability, visual design, and project management are essential in these new specialty areas. Besides, knowledge in these areas and in any industry is growing and changing all the time, and the professionals should be able to teach themselves what they need to know. And because IF promotes lifelong learning abilities in students, it is not surprising that instructors' think they are very important elements in the curriculum.

Because of the expanded roles and responsibilities, technical communicators are involved in more team works and more portions of project procedures, and their works are becoming more collaborative. These changes in the workplace are more or less impacting the academe. Technical communication is a program that emphasizes theory as well as practical skills. There, the implications of these changes are reflected in the course assignments and activities guided by technical communication instructors.

This study has discovered instructors' positive attitude toward information fluency, it also shows that their pedagogy emphasized more on the "information processing" and "critical thinking" sides of information fluency, and are mostly reluctant in expanding pedagogies on the teachings of specific tools that are valued by employers. This can be explained in two ways. First, technical communication programs and many theories in the field are opponents of the "tool-centered" approach to teaching technology. Many instructors and program administrators believe that students should learn more foundational concepts of technology than to learn to use the actual tool. They argue that given the speed at which new software tools are developed, any "new" application the students learned at school will most possibly become outdated when they enter the workplace. A second reason could be that it is too costly for programs to equip themselves with the most up-to-date software applications, and that the faculties themselves may not be always prepared to teach the latest software.

So, while trying their best to prepare students for the workplace, the academic programs can also pose some limitations for students to learn practical workplace information

fluency skills. The limitation can be lack of resources and the difficulty in providing professional contexts for students to practice their skills. Therefore, the next analytical category will look at what instructors perceive as the best pedagogical practice to counter these limitations—internship.

Analytical Category 3: Internship and Information Fluency Skill Acquisition

The study found that among many factors (student motivation, in-class instructions, mentoring, etc), instructors look at the opportunity of an internship to be the most beneficial in students' acquisition of practical workplace experiences and skills. To explain this result, I approach the analysis from the perspectives of "barriers and supports."

Barriers and Supports

Barriers do exist when academic programs try to implement the practical, employer-valued information fluency skills in the technical communication curricula. These barriers can be the pedagogy itself or in the number of resources a program can provide to students. As we have seen in the literature review, even well-cultivated collaborative learning pedagogical practices such as peer review, team writing, case study, and client projects still pose limitations when it comes to helping students become acquainted with the normal discourses, knowledgeable peers, and professional communities they will become part of after graduation. Although these practices are great for learning, their nature decides that they

are not good at providing the social, rhetorical contexts and the organizational environments for students to immerse.

Meanwhile, academic programs tend to shy away from teaching specific tools due to budget and human resource concerns. Not all programs have enough budgets to install cutting edge software applications in their technical communication labs, and not all faculty members are trained to teach these applications. According to A.W. Bates and Gary Poole, the lack of institutional support both for the technology and the pedagogy often affect faculties' ability to adopt technology. And this influence can be demising to the academic programs and to students, as Mark A. Sheilds states, "the traditional model of campus-based teaching, learning, and scholarship must adapt to new technological realities or die" (162).

However, if we suggest that technical communication programs should reverse what they have been doing all together and start putting time and money to purchase software and train their faculties to use and teach these tools, we are asking far too much. This kind of drastic change is neither realistic nor necessary. Before we set out for extreme reforms, we should always examine what we have to see if changes in current practice can satisfy the new needs. In the exiting practices of technical communication programs, internship can be a good way around the barriers and to allow students to acquire the necessary workplace information fluency skills.

Internship has been proved to provide both contexts and resources that complement formal school learning. According to the extended meaning of collaborative learning I discussed in Chapter Two, classroom-workplace collaboration will facilitate students'

acculturation to professional communities. Internship is a form of classroom-workplace collaborative learning; it "encourage students to relate to their study of theory to practice, permit faculty members to 'keep in touch with' current practices, and enable employers 'to influence college programs'" (Miller 20).

According to Miller, teachers of technical writing have advocated applying the mechanisms of nonacademic influence to their new programs. Internship should be adopted in technical communication programs because it does offer the best environment for the students to receive the "nonacademic influence" (20); and it helps us to do so without having to change the programs and exhaust our resources. Because of its many benefits, the respondents give internship the highest rating for its ability to provide support and overcome barriers in students' gaining workplace information fluency knowledge and skills while finishing their schooling.

Revisiting Assumptions from Chapter One

After discussing the findings and interpretations, it is time to revisit the four assumptions underlying this study. These assumptions are presented at the inception of this study (see Chapter One) and are based on my backgrounds and educated guesses. The four basic assumptions identified at the outset are discussed next in light of the analysis of this study's findings.

The first assumption underlying the research is that employers prefer to hire technical communicators who are good at handling information. That is, who know what information

they need, where to find, and how to evaluate and communication information. This assumption holds true according the first synthesized finding (See Chapter Four). The job recruitment postings samples in this study indicate that employers require technical communicator candidates to be good at all three aspects of information fluency.

The second assumption is that information fluency as a term and concept is not popular in the academic world of technical communication. This assumption turns out to be partially true. The survey indicates that instructors are not familiar with the term "information fluency," but are supportive of the concepts embedded in the term. They are teaching, in one way or another, the employer-valued information fluency skills in their classes. It is just they are not aware and are not intended as information fluency activities.

The third assumption is that, because instructors are unfamiliar with information fluency, their class activities will not include what employers hold to be highly useful and productive information fluency skills. This assumption does not hold to be true. The survey results reveals that many of the important skills related to information fluency are taught by instructors, even though they are not being identified as such.

The fourth and final assumption is that collaborative learning pedagogy can help students learn more practical information fluency skills while still fulfilling their academic requirements. This assumption holds partially true. Not all collaborative learning activities are perceived by the instructors as effective in providing students opportunities to immerse in real work environments. But most of the respondents chose internship as a helpful factor.

Summary

This chapter provided interpretative insights into the findings of the study and attempted to construct a holistic understanding of the research questions under investigation. The discussion revealed reasons on why employers ask for certain information skills in technical communicator candidates. It offered insights into the technical communication instructors' attitude and approach to information fluency and explained why they do what they do with information fluency even though it seemed like a very unfamiliar term to most of them. This chapter also explained why internship can play a big role in accelerating the academic program's information fluency effort.

There is a degree of caution in presenting an analysis of the findings uncovered in this study. First, the numbers of research samples I was able to collect for both instruments were moderate, comprising 67 job recruitment postings for the content analysis and 48 instructors for the survey. Second, the job posting samples was collected during a special economic situation where unemployment rate was high and economic growth was slow. Thus, the job requirements that may normally show in normal economic times are not represented. For these reasons, I must stress that the implications drawn from this study are specific to the sample job postings and instructors in the study.

Researcher bias can be another weakness of this qualitative inquiry. Because the analysis process was rather intuitive and personal, I recognize the possible subjectivity and bias in the claims I make regarding the meaning and interpretation of the data. Toward this end, and to help minimize this limitation, throughout the process of data collection and data

analysis, I engaged in ongoing critical reflection and compared my interpretation to relevant scholarships. Remaining open to the possibility that others might have told a different story, this chapter is essentially, and ultimately, a presentation of how I understand and make sense of the materials and the connections I see in them.

CHAPTER SIX: CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study is to explore the specific workplace information fluency skills valued by employers of technical communicators and how instructors perceive and teach these skills in the classroom, and to suggest how these findings can inform teaching practices in our profession. The conclusions from this study follow the research questions and the findings, and therefore, address four areas: (1) employer-valued workplace information fluency skills, (2) instructors' perceptions and attitudes toward information fluency, (3) instructors' approach toward teaching information fluency skills, and (4) what helps or hinders students' acquisition of information fluency skills. Following is a discussion of the major conclusions drawn from this research. This discussion is followed by recommendations and a final reflection on this study.

Employer-valued Workplace Information Fluency Skills

The first major finding of this research is that employers require technical communicators to have the capability to handle information with critical thinking, research, and technology skills. They value technical communicators who know their information needs, know where to find and how to evaluate information, and how to communicate information with specialized tools.

A conclusion to be drawn from this finding is that information fluency and related skills are becoming the major and unstoppable requirements in the workplace for technical communicators as organizations and companies expect their knowledge workers to have

increasing information responsibility, to be able to quickly adapt to any changes in the work environment, and to contribute to their effort in going global. Even though there historically has been a continual tension between industry and academe as to what should be expected of graduates from college, both sides seems to have reached an agreement on what constitute the attributes and competencies of an information fluent knowledge worker.

Employers do look for different levels of proficiency of these skills in job candidates who seek different levels of the positions. Usually they do recognize that new and experienced technical communicators can exhibit very different degrees of mastery in the same kind of skill (e.g., interviewing, planning, analyzing project, etc.). Therefore, candidates, especially those newly graduated from college, should not be too concerned or discouraged by job announcements that ask for experience. Besides, in almost all major, reputable technical communication programs, students are required—to one degree or another—to come out of the program with some practical experience. Oftentimes this is in the form of a formal, required or optional internship. Being a practice-oriented degree field, students recognize the importance of being able to prove or demonstrate their practical effectiveness, and so are incline to take internships even if they are optional. And for those who do not take internships, almost always one or more courses in a program have required assignments calling for interviewing subject matter experts and practitioners, researching and collecting subject matter information, and oftentimes also giving oral presentations about their findings from researching and interviewing. Thus, almost all new graduates have some practical

experience. The only difference between them and those with years of experience is a matter of degree but not a difference in kind.

Instructor Perceptions and Attitudes toward Information Fluency

The second key finding is that instructors of technical communication think the components and skill categories that constitute information fluency are extremely important to students' potential success in the workplace, although they are not familiar with the concept of information fluency.

A conclusion that can be drawn from this finding is that technical communication programs need a unified terminology to describe a whole constellation of different but related skills that can be called information fluency. The reason information fluency appears to be an unfamiliar term in the survey is not that technical communication programs do not emphasis on information fluency in their curricula. Information fluency used to be mainly the concern of the academic libraries. Therefore, for most instructors of technical communication, information fluency is a new terminology, a neologism. Even though the survey shows that many instructors are already teaching information fluency skills in their classes, they do not have a proper term to talk about these skills collectively. What they need to do next is to have more awareness to information fluency while keep teaching those same skills in a more mindful manner. The new term might serve to give our instructors a "handle" on how to talk about and understand the many skills that we have been teaching in a new light.

Because information fluency skills have become the unstoppable trend in the industry and in hiring, our conscious effort in building strength in this area will make our program and graduates more marketable, and it helps educate the professional field about information fluency, which will positively influence both sides in terms of improved collaboration. Today, employers and professors expect graduates and students to exhibit critical thinking, analysis, research, and technology skills at a fairly high level. However, there is little agreement among university faculties as when and how to prepare students for information fluency even though they perceive it as very important competency (Gullikson 591).

Study has shown that faculty–librarian collaboration on information fluency development positively affect the potential for undergraduate students to acquire information fluency (McGuinness 573). University faculties should collaborate with the academic library and other available resources to help build information fluency into the fabric of the curricula and help our students be more sophisticated seekers, consumers, and users of information. For example, faculty members at the researcher's university—UCF—have several resources within easy reach. These resources include the library's information fluency instruction program, the Information Literacy online modules, and other assistances provided by the UCF Information Fluency Office.

Instructor Approach toward Teaching Information Fluency Skills

The study's third key finding is that instructors of technical communication are implementing most of the employer-valued workplace information fluency skills in their

technical communication/writing courses. However, they are doing so non-systematically and without being aware that these skills are contributing to information fluency.

A conclusion to be drawn from this finding is that current technical communication programs should already have sound bases on which to build information fluency initiatives. The sound base comes from the individual instructor's knowledge of information fluency building skills. The survey results show that current technical communication programs has a lot of potential to start promote information fluency without having to launch extreme changes. Now that the instructors are already implementing many of the workplace information fluency skills in their teaching, we do not have to start from scratch. Now, what we need to incorporate in the discipline is awareness of the concept and systematic approaches. The step to take before having organized curricular is the raise of awareness. Awareness can bring a higher level of commitment to information fluency. And the systematic approaches give us the strategies and techniques to solve problems or situations.

What Helps or Hinders Students' Acquisition of Information Fluency Skills

This study's fourth and final finding is that most instructors think that students can better learn work-related skills through internships. A conclusion to be drawn from this finding is that while the program resources and classroom activities may restrict students' exposure to professional contexts, we can treat internship as another form of social constructivist pedagogy, and expect the students to put together what they learned at school and to gain new insights about information fluency and the profession in internships. Courses

and in-class instructions are not enough to prepare students for the workplace, and we should not expect it to. The purpose of academic courses should be to provide theories, concepts, and basic strategies and tactics in creating and solving workplace problems. They also provide students with the basic skills of information fluency and lifelong learning abilities. They have limitations and should not to be expected to fully provide the context and resources that prevail in the real workplace.

The workplace is goal-oriented and it relies on producing outcome and get thing done rather than on theory, history, or general appreciation. Technical communication students, especially in their senior year, should be involved in both environment and be familiar with the rhetoric of both institutions. With the basics learned from courses, students can expand and build new workplace knowledge while being immersed in the real work environment.

Being a practice-oriented degree field, both students and faculty recognize the importance of being able to prove or demonstrate their practical experiences, and being practical can have "low" and "high" senses. Richard Bernstein suggests that the "low" sense of practical "is not concerned with theory (even anti-theoretical or anti-intellectual" and it emphasis the "mundane and bread-and-butter activity," and cares about "how to get along in the rough and tumble of the world" (x). The high sense, on the other hand, concerns human well-being and the future of community life. Carolyn Miller recognizes that technical communication has been associated with the low forms of practice since its beginning in the late nineteenth century (15). She suggests that internship could be one way of applying the

higher sense of practical to the curriculum as it can effectively bridge the "uneasy relationship between nonacademic practice and academic instruction" (18).

Recommendations

In this section, I offer recommendations based on the findings, analysis, and conclusions of this study. The recommendations that follow are for (a) undergraduate technical communication program administrators (b) instructors, and (c) recommendations for future research.

Recommendations for Program Administrators

Based on the findings, analysis, and conclusions of this study, I suggest that administrators of undergraduate technical communication programs should consider:

1. Educate faculty members about information fluency. Start by connecting with the university library to help faculties understand information fluency on a general, non-discipline-specific level. This should provide them with the basics of information fluency, a based on which they can adapt it to the discipline.
2. At the same time, administrators should consider develop and implement formal and discipline-specific training programs for faculties. The program can include information fluency as a part of faculty professional development, and organize seminars and workshops that targeted to develop information fluency awareness and exchange best-practices in the teaching of information fluency.

3. Encourage and promote educational research on discipline-specific information fluency development.
4. Organize a faculty committee on information fluency and plan for key program outcomes and assignments.
    - Update skills list. The specific employer-valued workplace information fluency skills listed in Appendix G might be a good starting point. The committee may review and revise the list on an ongoing basis, adding new items and removing outdated requirements.
    - Plan information fluency into core courses. For each core course of the degree program, create guidelines on major projects, faculty designed activities, and designed outcomes concerning information fluency.
5. Create more industry-program partnership and/or connection with experiential learning departments on campus to provide more valuable internship opportunities to students.
6. Organize ongoing assessment (e.g., through surveys) of graduates' employment status and job satisfaction to uncover in a timely basis any problems, issues, and/or challenges that may be caused by information fluency instructions and resources should be identified to help students with such issues.

Recommendations for Technical Communication Instructors

Instructors of technical communication courses may consider:

1. Positively and consciously engage in developing information fluency competency among students. Start familiarizing students with the concept with the help of academic library services, where instruction and lectures are provided to explain information fluency generally, with no discipline specific information.
2. Use the department-created skill list and core course guidelines on major writing projects and activities.
3. Identify issues in teaching and seek or share solutions with colleagues and the department information fluency committee.

Recommendations for Future Research

I recommend further studies be conducted to develop a more comprehensive understanding of workplace information fluency requirements and how programs and instructors perceive and teach to prepare graduates to satisfy these requirements.

In light of this, the following studies may be considered:

1. **Content Analysis with Larger and More Normal Samples**. Based on the limitation of the current study and to correct the possible bias in sampling caused by the economic situation, a content analysis of a larger sample collected during a normal economic time may be conducted to further determine and assess the extent to which the same or similar findings on workplace information fluency skills and requirements would be uncovered.
2. **Semi-structured Interviews with Instructors and Employers**. I also recommend

3. **Designing Discipline-specific Assessment Instruments and Methods**. Empirical studies should be conducted to develop approaches to assess students' development in information fluency. In Chapter One, I listed four most well-known IF assessment tools.

   - The Educational Testing Service (ETS): *Information and Communications Technologies Literacy Assessment*, or ICT Literacy Assessment
   - Kent State University: *Project SAILS* (Standardized Assessment of Information Literacy Skills)
   - The Bay Area Community Colleges: *Information Competency Assessment Project*

- James Madison University: *Information Competency Exams*

These tools are created to assess students' general information competency development. One of the future tasks for the technical communication discipline is to develop our own discipline-specific assessment tools. Possible instruments to be developed can include assessment exams designed to gauge the information fluency skills and routine surveys used to gauge student and instructor perception of the existing program.

To ensure that students receive effective instruction related to core information fluency skills, strong assessment practices are essential. Because information fluency is no longer library-centered and is now integrated in the curriculum, we cannot keep using the library instruction assessment (assignment) methods. Further empirical studies should be conducted to establish benchmark (something equivalent in function as the ACRL standards) for assessment practices that encompass the broader sense of information fluency as knowledge acquisition and management with related skills.

Researcher Reflections

Stephen Doheny-Farina, writing in *Written Communication*, notes that "By learning more about nonacademic contexts for writing, we are learning more about the kinds of rhetorical demands faced by many of our college graduates" (159). Paul Anderson also remarks, "We must first understand the profession, then design our curricular accordingly.

Only if we understand intimately the job we intend to prepare our students to perform can we create effective professional programs" (161). In this dissertation, I have attempted to explore the nonacademic contexts for technical communication and to identify the specific information fluency skills that the profession value in technical communicators. I have situated these skills and competencies within the larger framework of information fluency as defined by the University of Central Florida, the Associated Colleges of the South, as well as from the industry.

However, the goal of identifying these skills is not to suggest that academic programs should immediately replace existing practices with teaching these practical skills. Miller has thoughtfully pointed out the importance of questioning nonacademic practices before incorporating them into curricula.

> But the academy does not have to be just a receptacle for practices and knowledge created elsewhere. The academy itself is also a set of practices, including those of observation, conceptualization, and instruction—practices that create their own kind of knowledge. Such knowledge allows the academy to provide a standpoint for inquiry into and criticism of nonacademic practices. (23)

Therefore, my research also turned to the academy and asked those who worked at the frontline of education—instructors of technical communication—about their attitude toward the value of information fluency.

Through this study, I want to call attention to the benefits information fluency can bring to our discipline and our students. However, this single study can only address a limited

number of issues and the effect it can have in the discipline is meager. A lot more work need to be done in further defining, systemizing, implementing, and assessing information fluency within the technical communication curriculum. I sincerely hope that, in the near future, more researchers and instructors of technical communication will take up the effort in exploring those exiting faces of information fluency.

APPENDIX A: THE COMPONENTS OF FLUENCY WITH INFORMATION TECHNOLOGY (NATIONAL RESEARCH COUNCIL)

Contemporary Skills

1. Setting up a personal computer
2. Using basic operating system features
3. Using a word processor to create a text document
4. Using a graphics and/or artwork package to create illustrations, slides, or other image-based expressions of ideas
5. Connecting a computer to a network
6. Using the Internet to find information and resources
7. Using a computer to communicate with others
8. Using a spreadsheet to model simple processes or financial tables
9. Using a database system to set up and access useful information
10. Using instructional materials to learn how to use new applications or Features

Foundational Concepts

1. Computers
2. Information systems
3. Networks
4. Digital representation of information
5. Information organization
6. Modeling and abstraction
7. Algorithmic thinking and programming
8. Universality
9. Limitations of information technology
10. Societal impact of information and information technology

Intellectual Capabilities

1. Engage in sustained reasoning.
2. Manage complexity.
3. Test a solution.
4. Manage problems in faulty solutions.
5. Organize and navigate information structures and evaluate information.
6. Collaborate.
7. Communicate to other audiences.
8. Expect the unexpected.
9. Anticipate changing technologies.
10. Think about information technology abstractly.

(http://www.nap.edu/openbook.php?record_id=6482&page=4#p200064b29960004001)

APPENDIX B: LIST OF ANALYZED JOB RECRUITMENT POSTINGS

Table 4: List of Analyzed Job Postings

No.	Date	Job Title	Company	Industry Type
1	1/6/2009	Technical Writer	Creative IT	IT Services
2	1/14/2009	Technical Writer	CyberSource	IT Services
3	1/29/2009	Documentation Manager	FrontRange Solutions	Software
4	1/29/2009	Technical Writer	Siemens Transportation Systems	
5	2/3/2009	Sr. Technical Writer	GovDelivery	Software
6	2/6/2009	Technical Writer	Sagitec Solutions	Software
7	2/12/2009	Sr. Technical Writer	Juniper Networks	
8	2/17/2009	Technical Writer	Gilson Software Solutions	Software
9	2/19/2009	Technical Writer/Editor	*Company Confidential*	
10	2/20/2009	Technical Writer/Editor	UNITECH	Government and military
11	2/25/2009	Technical Writer Lead	Jeppesen	Aerospace and defense/Software
12	2/25/2009	Technical/Procedures Writer	KnowledgeStaff	Education
13	2/27/2009	Sr. Technical Writer	Websense	Software
14	3/2/2009	Technical writer/Analyst	Matheson Trucking	IT services
15	3/3/2009	Technical Writer	O2Micro	IT services
16	3/5/2009	Technical Documentation Writer	Softscape	IT services
17	3/9/2009	Sr. Technical Writer	Alion Science&Technology	
18	3/10/2009	Technical Writer	Coca-cola	
19	3/11/2009	Technical Writer/Editor I	Raytheon	Aerospace
20	3/11/2009	Technical Writer	Clovis	IT services
21	3/12/2009	Sr. Technical Writer	Lockheed Martin	IT services
22	3/13/2009	Engineering Technical Writer	M.C. Dean	Engineering
23	3/16/2009	Technical writer	LionBridge	IT services
24	3/18/2009	Technical Writer	Disney Interactive Media	
25	3/18/2009	Technical Writer	Kaseman, Llc	
26	3/19/2009	Technical Writer	MIDI	Healthcare
27	3/20/2009	Sr. Technical Writer	Technilogy Consulting	IT services
28	3/23/2009	Technical IT Writer	Management and Technology Solutions	IT services
29	3/25/2009	Lead Technical Writer	Broadridge	
30	3/25/2009	Technical Writer/Editor	Fulcrum	IT services
31	3/25/2009	Technical Communicator	National Renewable Energy Laboratory	
32	3/25/2009	Technical Writer	Geotest - Marvin Test Systems	Aerospace
33	3/26/2009	Technical Writer	Akimeka Technologies	Government & military
34	3/28/2009	Technical Proposal Manager/Writer	*Company Confidential*	
35	3/29/2009	Technical Writer	Scneider Electric	

No.	Date	Job Title	Company	Industry Type
36	3/30/2009	Technical Writer	McAfee	Software
37	3/30/2009	Technical Writer	Tessada & Associates	Government & military
38	4/1/2009	Technical Writer	*recruiting agency*	
39	4/1/2009	Technical Writer	Nasatka Barrier	Security and surveillance
40	4/1/2009	Technical Writer	Wyle	Education
41	4/2/2009	Technical Writer	Productive Engineering	Engineering
42	4/3/2009	Technical Writer II	Boehringer Ingelheim	Bio tech
43	4/5/2009	Technical Writer	*recruiting agency*	
44	4/6/2009	Technical Writer	Booz Allen Hamilton	
45	4/7/2009	Technical Writer	Genetec inc	Security and surveillance
46	4/7/2009	Technical Communicator	Medidata Solutions	IT services
47	4/8/2009	Technical Writer	CSC; Computer	IT services
48	4/9/2009	Sr. Technical Writer	InterSystems Corporation	IT services
49	4/10/2009	Technical Writer/Project Analyst	Platinum Solution	IT services
50	4/14/2009	Technical Writer	CA	IT services
51	4/14/2009	Technical Writer/Business Analyst	*recruiting agency*	
52	4/15/2009	Sr. Technical Writer	AT&T	
53	4/16/2009	Sr. Technical Writer	Amazon	
54	4/16/2009	Technical Writer	Industrial Dynamics	Manufacturing
55	4/17/2009	Technical Writer	Laserfiche	Software
56	4/17/2009	Technical Writer	*recruiting agency*	
57	4/17/2009	Technical Writer	Kratos Defense & Security Solutions	Aerospace and defense
58	4/20/2009	Technical Writer/Information Developer	Symantec	Security
59	4/20/2009	Technical Writer	Umpqua Bank	
60	4/20/2009	Technical Writer	Navistar, Inc	Software
61	4/22/2009	Technical Writer	*recruiting agency*	
62	4/22/2009	Technical Writer	*Company Confidential*	
63	4/23/2009	Technical Writer	LCG System	IT Services
64	4/24/2009	Proposal Specialist	*recruiting agency*	
65	4/29/2009	Sr. Technical Writer	Battelle	Science and technology
66	4/30/2009	Technical Writer	Molina Healthcare	Insurance & healthcare services
67	4/30/2009	Proposal/Technical Writer	Cogent Systems, Inc., Computer	IT Services

APPENDIX C: ONLINE SURVEY FOR INSTRUCTORS

1. Your educational rank:
   □ Graduate student
   □ Assistant professor
   □ Associate professor
   □ Full professor
   □ Adjunct
   □ Other, please specify _____

2. You are teaching (Mark all relevant):
   □ Face-to-face
   □ Online
   □ ITV

3. Your knowledge of information fluency (Mark all relevant):
   □ Do research on information fluency
   □ Have read a few (1-3) books and/or articles on information fluency
   □ Have read several (3 and more) books and/or articles on information fluency
   □ Have heard about the term but are not familiar with the concept
   □ Never heard about information fluency

4. In association with what topics do you implement *audience analysis* in your technical writing/communication courses? (Mark all relevant)
   □ Job application materials
   □ Instructions
   □ Workplace correspondence
   □ Proposals
   □ Reports
   □ Visual design
   □ Persuasion and rhetoric
   □ Research process
   □ I teach it as a separate unit (not associated with any other topics).
   □ Never
   □ Other, please specify _____

5. In association with what topics do you implement *project analysis* (goals, objectives, scope, and requirement) in your technical writing/communication courses? (Mark all relevant)
   □ Job application materials
   □ Instructions
   □ Workplace correspondence
   □ Proposals
   □ Reports
   □ Visual design

□ Persuasion and rhetoric
□ Research process
□ I teach it as a separate unit (not associated with any other topics).
□ Never
□ Other, please specify _____

6. In association with what topics do you implement *information gathering* (interview, study existing material) in your technical writing/communication courses? (Mark all relevant)

□ Job application materials
□ Instructions
□ Workplace correspondence
□ Proposals
□ Reports
□ Visual design
□ Persuasion and rhetoric
□ Research process
□ I teach it as a separate unit (not associated with any other topics).
□ Never
□ Other, please specify _____

7. In association with what topics do you implement *document design* in your technical writing/communication courses? (Mark all relevant)

□ Job application materials
□ Instructions
□ Workplace correspondence
□ Proposals
□ Reports
□ Visual design
□ Persuasion and rhetoric
□ Research process
□ I teach it as a separate unit (not associated with any other topics).
□ Never
□ Other, please specify _____

8. Do you facilitate the following activities in your technical writing/communication course(s)? (Mark all relevant)

□ Testing documents for usability
□ Developing documentation templates
□ Developing documentation guidelines and standards
□ Creating and maintaining document repository
□ Planning project
□ None

9. How would you rate the usefulness of the following software skills in students' professional success? (Mark all relevant)

	Extremely Useful	Useful	Doesn't Matter Much	Not Useful
Microsoft Office Suite	□	□	□	□
Desktop Publishing (e.g., FrameMaker, Inmedius S1000D Suite)	□	□	□	□
Graphic Design & Illustration (e.g., Adobe Illustrator, Photoshop)	□	□	□	□
Help Authoring Tools (e.g., RoboHelp, MadCap)	□	□	□	□
Content/Knowledge Management Systems	□	□	□	□
Markup Languages (e.g., HTML, XML)	□	□	□	□

10. In your opinion, how helpful are the following competencies in a student's success in the workplace?

	Extremely Important	Important	Doesn't Matter Much	Not Important
Being able to recognize information needs	□	□	□	□
Being able to gather and evaluate information	□	□	□	□
Being able to apply information to solve problems	□	□	□	□
Being able to manipulate information technology	□	□	□	□

11. What are some important factors in helping students acquire practical workplace knowledge before they graduate? (Mark all relevant)

□ Student motivation
□ Instruction (in class)
□ Mentoring (outside class)
□ Interdisciplinary courses
□ Internship
□ Program-industry cooperation
□ Technology resources
□ Other, please specify_____

12. Which of the following would you encourage your student to do in order to keep up-to-date knowledge of advances in information technology? (Mark all relevant)

□ Reading scholarly journals
□ Reading professional magazines and trade publications
□ Attending fairs or conferences
□ Taking short-term internship in industry
□ Participating in professional organizations
□ Paying attention to information technology researches happening on campus
□ Other, please specify _____

APPENDIX D: DATA SUMMARY TABLES FOR CONTENT ANALYSIS (CA)

Table 5: Data Summary Table for CA Finding 1

		Recognize Information Needs	
	Company	**Analyze Audience**	**Analyze Projects**
		28 (42%)	36 (54%)
1	Creative IT		√
2	CyberSource	√	√
3	FrontRange Solutions		√
4	Siemens Transportation	√	
5	GovDelivery	√	√
6	Sagitec Solutions	√	
7	Juniper Networks		
8	Gilson Software		√
9	*Confidential*		√
10	UNITECH	√	
11	Jeppesen	√	√
12	Knowledge Staff		
13	Websense		√
14	Matheson	√	√
15	O2Micro	√	
16	Softscape		√
17	Alion	√	
18	Coca-cola		
19	Raytheon	√	√
20	Clovis		√
21	Lockheed Martin	√	
22	M.C. Dean		
23	LionBridge		
24	Disney Interactive Media	√	√
25	Kaseman		√
26	MIDI		
27	Technology Consulting	√	√
28	Management and Technology Solutions		
29	Broadridge		√
30	Fulcrum IT	√	
31	National Renewable Energy		√
32	Geotest		√
33	Akimeka Technologies		√
34	Company Confidential		√
35	Scneider Electric	√	√

		Recognize Information Needs	
	Company	**Analyze Audience**	**Analyze Projects**
36	McAfee		√
37	Tessada & Associates	√	
38	recruiting		
39	Nasatka Barrier		√
40	Wyle	√	
41	Productive Engineering	√	
42	Boehringer Ingelheim		√
43	recruiting		√
44	Booz Allen Hamilton		
45	Genetec		
46	Medidata Solutions	√	
47	CSC	√	
48	InterSystems		
49	PlatinumSolution		√
50	CA	√	√
51	recruiting	√	√
52	AT&T	√	
53	Amazon	√	√
54	Industrial Dynamics		√
55	Laserfiche	√	
56	recruiting		√
57	Kratos		√
58	Symantec		
59	Umpqua Bank		√
60	Navistar		√
61	recruiting	√	
62	Company confidential		
63	LCG		√
64	recruiting	√	
65	Battelle		√
66	Molina Healthcare		
67	Cogent	√	
	Total Companies Checked	49 (73%)	

Table 6: Data Summary Table for CA Finding 2

		Gather Information	
	Company	**Interview**	**Study Existing Materials**
		47 (70%)	38 (57%)
1	Creative IT	√	
2	CyberSource	√	√
3	FrontRange Solutions	√	
4	Siemens Transportation	√	√
5	GovDelivery		
6	Sagitec Solutions	√	
7	Juniper Networks		√
8	Gilson Software	√	√
9	Company Confidential	√	√
10	UNITECH		√
11	Jeppesen	√	
12	Knowledge Staff	√	
13	Websense	√	√
14	Matheson	√	√
15	O2Micro	√	√
16	Softscape	√	
17	Alion	√	
18	Coca-cola		
19	Raytheon	√	√
20	Clovis	√	√
21	Lockheed Martin		√
22	M.C. Dean	√	√
23	LionBridge		
24	Disney Interactive Media	√	
25	Kaseman	√	
26	MIDI	√	√
27	Technology Consulting		√
28	Management and Technology Solutions		√
29	Broadridge	√	√
30	Fulcrum IT	√	√
31	National Renewable En.		
32	Geotest	√	√
33	Akimeka Technologies		

		Gather Information	
	Company	**Interview**	**Study Existing Materials**
34	Company Confidential		√
35	Scneider Electric		√
36	McAfee	√	√
37	Tessada & Associates		
38	recruiting	√	
39	Nasatka Barrier		√
40	Wyle	√	
41	Productive Engineering	√	√
42	Boehringer Ingelheim	√	√
43	recruiting	√	√
44	Booz Allen Hamilton	√	√
45	Genetec		√
46	Medidata Solutions	√	√
47	CSC	√	√
48	InterSystems	√	√
49	PlatinumSolution	√	
50	CA	√	√
51	recruiting		
52	AT&T	√	
53	Amazon		
54	Industrial Dynamics	√	√
55	Laserfiche	√	√
56	recruiting		
57	Kratos	√	
58	Symantec		
59	Umpqua Bank	√	
60	Navistar	√	
61	recruiting	√	√
62	Company confidential	√	
63	LCG	√	√
64	recruiting	√	
65	Battelle	√	√
66	Molina Healthcare		
67	Cogent	√	
	Total Companies Checked	62 (93%)	

Table 7: Data Summary Table for CA Finding 3

		Interpret, Organize and Communicate Information		
	Company	**Visuals**	**User documentation**	**Confine to Standards**
		22 (33%)	28 (42%)	32 (48%)
1	Creative IT			√
2	CyberSource	√	√	
3	FrontRange			√
4	Siemens Transportation		√	√
5	GovDelivery	√		
6	Sagitec Solutions		√	
7	Juniper Networks			√
8	Gilson Software			
9	Confidential		√	
10	UNITECH		√	√
11	Jeppesen			√
12	Knowledge Staff			
13	Websense		√	√
14	Matheson	√	√	√
15	O2Micro		√	√
16	Softscape			
17	Alion	√	√	√
18	Coca-cola			√
19	Raytheon		√	
20	Clovis			√
21	Lockheed Martin		√	√
22	M.C. Dean	√		
23	LionBridge	√		
24	Disney Interactive Media	√	√	
25	Kaseman		√	√
26	MIDI	√		
27	Technology Consulting			
28	Management and Technology Solutions			
29	Broadridge	√		
30	Fulcrum IT		√	
31	National Renewable Ene.			
32	Geotest			
33	Akimeka			√
34	Confidential			√
35	Scneider Electric	√		√

		Interpret, Organize and Communicate Information		
	Company	**Visuals**	**User documentation**	**Confine to Standards**
36	McAfee	√		√
37	Tessada & Associates		√	√
38	recruiting	√	√	
39	Nasatka Barrier			√
40	Wyle		√	√
41	Productive Engineering		√	√
42	Boehringer Ingelheim			√
43	recruiting	√		√
44	Booz Allen Hamilton			
45	Genetec			
46	Medidata Solutions		√	
47	CSC		√	
48	InterSystems	√		
49	PlatinumSolutio		√	
50	CA	√		
51	recruiting			√
52	AT&T	√	√	
53	Amazon			√
54	Industrial Dynamics			
55	Laserfiche	√		
56	recruiting		√	
57	Kratos	√	√	√
58	Symantec			
59	Umpqua Bank			√
60	Navistar			√
61	recruiting	√	√	√
62	confidential	√		√
63	LCG	√	√	
64	recruiting			√
65	Battelle		√	
66	Molina	√		
67	Cogent		√	
	Total Companies Checked	58 (87%)		

Table 8: Data Summary Table for CA Finding 4

		Form and Promote Best Practices			
	Company	**Template, Guidelines and Standards**	**Evaluate and Test**	**Knowledge Base/Document Repository**	**Plan Projects**
		25 (37%)	27 (40%)	20 (29%)	29 (43%)
1	Creative IT	√		√	√
2	CyberSource	√			
3	FrontRange	√	√		
4	Siemens Transportation				√
5	GovDelivery	√			
6	Sagitec Solutions		√		
7	Juniper Networks				
8	Gilson Software		√		√
9	*Confidential*		√		√
10	UNITECH		√		
11	Jeppesen		√		
12	Knowledge Staff				
13	Websense				
14	Matheson				
15	O2Micro		√		
16	Softscape	√	√	√	√
17	Alion			√	√
18	Coca-cola		√		
19	Raytheon				
20	Clovis	√			
21	Lockheed Martin				
22	M.C. Dean				
23	LionBridge			√	√
24	Disney IM			√	
25	Kaseman	√			
26	MIDI	√			
27	Technology Consulting				
28	Management and Technology Solutions	√	√	√	
29	Broadridge				√
30	Fulcrum IT	√			√
31	National Renewable En			√	
32	Geotest	√	√	√	
33	Akimeka			√	

		Form and Promote Best Practices			
	Company	**Template, Guidelines and Standards**	**Evaluate and Test**	**Knowledge Base/Document Repository**	**Plan Projects**
34	Confidential			√	
35	Scneider Electric				√
36	McAfee			√	
37	Tessada & Associates	√	√		√
38	recruiting			√	√
39	Nasatka Barrier	√	√		
40	Wyle				
41	Productive Engineering				
42	Boehringer Ingelheim		√	√	
43	recruiting				
44	Booz Allen Hamilton	√			√
45	Genetec		√		√
46	Medidata Solutions	√			√
47	CSC	√		√	√
48	InterSystems	√	√		
49	PlatinumSolutio		√		
50	CA		√		√
51	recruiting	√	√	√	√
52	AT&T		√		
53	Amazon	√			√
54	Industrial Dynamics	√	√		√
55	Laserfiche		√	√	
56	recruiting	√			√
57	Kratos	√		√	√
58	Symantec	√		√	√
59	Umpqua Bank		√		√
60	Navistar				√
61	recruiting		√	√	
62	confidential	√	√		√
63	LCG		√		
64	recruiting	√			
65	Battelle		√		√
66	Molina Healthcare			√	√
67	Cogent				√
	Total Companies Checked	58 (87%)			

Table 9: Data Summary Table for CA Finding 5

		Information Technology					
	Company	**Office**	**KM**	**Desktop Publishing**	**Graphic**	**Help**	**Up-to-date knowledge**
		30 (45%)	20 (29%)	14(21%)	22 (33%)	13 (19%)	11 (16%)
1	Creative IT					√	
2	CyberSource		√		√	√	√
3	FrontRange Solutions	√		√	√		√
4	Siemens Transportation						
5	GovDelivery						
6	Sagitec Solutions	√				√	
7	Juniper Networks	√					
8	Gilson Software	√				√	
9	*Confidential*						
10	UNITECH						
11	Jeppesen			√			
12	Knowledge Staff		√				
13	Websense		√			√	√
14	Matheson	√	√		√		
15	O2Micro						
16	Softscape		√				√
17	Alion						
18	Coca-cola						
19	Raytheon					√	
20	Clovis						
21	Lockheed Martin	√					
22	M.C. Dean	√					
23	LionBridge		√				
24	Disney Interactive Media	√	√		√		√
25	Kaseman	√					
26	MIDI	√	√		√	√	
27	Technology Consulting	√					
28	Management and Technology Solutions						
29	Broadridge		√	√	√		√
30	Fulcrum IT	√		√			
31	National Renewable En.	√	√		√		
32	Geotest						
33	Akimeka	√	√				
34	*Confidential*						

		Information Technology					
	Company	**Office**	**KM**	**Desktop Publishing**	**Graphic**	**Help**	**Up-to-date knowledge**
35	Scneider Electric		√	√	√		
36	McAfee						
37	Tessada & Associates	√		√			
38	recruiting		√	√	√	√	√
39	Nasatka Barrier	√			√		√
40	Wyle	√					√
41	Productive Engineering	√			√		
42	Boehringer Ingelheim						
43	recruiting			√	√		
44	Booz Allen Hamilton	√	√		√		
45	Genetec			√			
46	Medidata Solutions	√	√		√	√	
47	CSC			√			
48	InterSystems						√
49	PlatinumSolutio	√					
50	CA	√			√		
51	recruiting	√	√		√		
52	AT&T	√			√		
53	Amazon		√				
54	Industrial Dynamics						
55	Laserfiche		√				
56	recruiting	√	√			√	
57	Kratos	√			√	√	
58	Symantec		√	√			√
59	Umpqua Bank						
60	Navistar	√		√			
61	recruiting			√	√		
62	*confidential*	√			√		
63	LCG				√	√	
64	recruiting					√	
65	Battelle						
66	Molina Healthcare	√			√		
67	Cogent	√		√			
	Total Companies Checked	62 (93%)					

APPENDIX E: ROADMAP OF FINDIGNS FOR CONTENT ANALYSIS

CA Finding 1
The majority (49 of 67 [73%]) of job postings indicate that the employers prefer to hire technical communicators with the ability to recognize information needs of projects. The specific job functions/skills that represent this competence are to identify gaps in knowledge by:

- Analyzing projects(36 [54%])
- Analyzing audience (28 [42%])

CA Finding 2
The overwhelming majority (62 of 67 [93%]) of job postings indicate that the employers prefer to hire technical communicators with competence to acquire needed information and evaluate information. The specific job functions/skills that represent this competence are to acquire information by:

- Interviewing technical and managerial professionals (47 [70%])
- Studying existing documents and products (38 [57%])

CA Finding 3
The majority (58 of 67 [87%]) of job postings indicate that the employers prefer to hire technical communicators with competence in interpreting, organizing, and communicating information. The specific job functions/skills are:

- Creating documents according to corporate/industrial standards and compliances (32 [48%])
- Converting technical information to easy-to-understand user documentation (28 [42%])
- Creating and formatting visuals to illustrate key points in document (22 [33%])

CA Finding 4
The majority (58 of 67 [87%]) of job postings indicate that the employers prefer to hire technical communicators with competence in rearranging and circulate information. The specific job functions/skills represent this competence are:

- Planning project and providing estimates of time and resources (29 [43%])
- Evaluating and testing documentation to ensure accuracy and ease of use (27 [40%])
- Developing and maintaining templates, documentation guidelines and standards (25 [37%])
- Organizing and updating knowledge base/documentation repository (20 [29%])

CA Finding 5
The overwhelming majority (62 of 67 [93%]) of job postings indicate that the employers prefer to hire technical communicators with competence in understanding technology and using information technology tools. The specific job functions/skills are:

- Microsoft Office Suite (34 [51%])
- Content/Knowledge Management (25 [37%])
- Graphic Design & Illustration (e.g., Adobe Illustrator, Photoshop) (24 [36%])

- Web Markup Languages (e.g., HTML) (22 [33%])
- Help Authoring Tools (e.g., RoboHelp, MadCap) (14 [21%])
- Desktop Publishing (e.g., FrameMaker, Inmedius S1000D Suite) (14 [21%])
- Having up-to-date knowledge about advances in technology (14 [21%])

APPENDIX F: DETAILED LIST OF EMPLOYER-VALUED WORKPLACE INFORMATION FLUENCY SKILLS

1. Recognize information needs
    - Analyzing project
    - Analyzing audience
2. Gather/acquire information
    - Interviewing technical and managerial professionals
    - Studying products and procedures
    - Studying blueprint specifications and drawings
    - Studying existing documents
3. Interpret, organize, and communicate information
    - Creating and formatting visuals to illustrate key points in document
    - Converting technical information to easy-to-understand user documentation
    - Creating documents according to corporate/industrial standards and compliances
4. Synthesize information to form and promote best practices
    - Evaluating and testing documentation to ensure accuracy and ease of use
    - Developing and maintaining templates, documentation guidelines and standards
    - Organizing and updating knowledge base/documentation repository
    - Planning project and providing estimates of time and resources
5. Use information technologies
    - Microsoft Office Suite
    - Desktop Publishing (e.g., FrameMaker, Inmedius S1000D Suite)
    - Content/Knowledge Management
    - Graphic Design & Illustration (e.g., Adobe Illustrator, Photoshop)
    - Help Authoring Tools (e.g., RoboHelp, MadCap)
    - Web Markup Languages (e.g., HTML)
    - Having up-to-date knowledge about advances in technology

APPENDIX G: CONSISTENCY CHART OF FINDINGS, INTERPRETATIONS, AND CONCLUSIONS

Table 10: Consistency Chart of Findings, Interpretations, and Conclusions

Key Findings	Interpretations	Conclusions
1. Employers value technical communicators who know what information they need to do their job, who are competent in finding, evaluating, and using information, and who know how to use specified tools for gathering and communicating information effectively, efficiently, and ethically.	• The information age requires that the knowledge workers to assume information responsibility. • Technical communicators face the challenge of changing working environment, approach, and the tools with which they perform their daily job. Being information fluent is especially important to quickly adapt to these changes. • The increasing complexity of working and communicating within and across corporate, cultural, and national boundaries means technical communicators will work in global virtual teams, communicate in global networks, the use digital communication technologies.	Information fluency and related skills are becoming the major and unstoppable requirements in the workplace for technical communicators as organizations and companies expect their knowledge workers to have increasing information responsibility, to be able to quickly adapt to any changes in the work environment, and to contribute to their effort in going global.
2. Instructors of technical communication think the competencies that constitute information fluency are extremely important in students' potential success in the workplace, although they are not familiar with the concept of information fluency.	• Information is a new terminology. • The new term might give our instructors a "handle" on how to talk about and understand something they are already teaching but is too diverse to discuss as one concept. • It helps faculty, students, and even employers to	Technical communication programs need a terminology to describe a whole constellation of different but related skills that can be called information fluency.

Key Findings	Interpretations	Conclusions
	develop an awareness of the real intellectual and conceptual connection among these different factors or elements. • The skills or techniques taught by the respondents are all interconnected because they are all aspects of information fluency, working toward making students information fluent.	
3. Instructors of technical communication are not aware they are already implementing most of the employer-valued workplace information fluency skills in their technical communication/writing courses.	• Technical communicators are expanding their specialty areas. • Knowledge in any industry is growing and changing all the time, and the professional should be able to teach themselves what they need to know. • IF promotes lifelong learning abilities in students, it is not surprising that instructors' think they are very important elements in the curriculum.	Current technical communication programs should already have sound bases on which to build information fluency initiatives. The sound base comes from the individual instructor's knowledge of information fluency building skills.
4. Most instructors think that students can better learn work-related skills through internships.	• Classroom instructions poses barrier when it comes to helping students become acquainted with the professional communities they wish to enter after graduation. • The limitations include the lack of social, rhetorical contexts and the	While the program resources and classroom activities may restrict students' exposure to professional contexts, we can treat internship as another form of social constructivist pedagogy, and expect the students to put together what they learned at school and to gain new insights about

Key Findings	Interpretations	Conclusions
	organizational environment information. • Internship offers the best environment for the students to be immersed in the workplace contexts and communities.	information fluency and the profession in internships.

APPENDIX H: IRB NOTICE OF EXEMPT REVIEW

University of Central Florida Institutional Review Board
Office of Research & Commercialization
12201 Research Parkway, Suite 501
Orlando, Florida 32826-3246
Telephone: 407-823-2901, 407-882-2012 or 407-882-2276
www.research.ucf.edu/compliance/irb.html

Notice of Exempt Review Status

From: **UCF Institutional Review Board**
FWA00000351, Exp. 10/8/11, IRB00001138

To: **Yuejiao Zhang** and Co-PIs if applicable:

Date: **May 22, 2009**

IRB Number: **SBE-09-06279**

Study Title: **Defining Workplace Information Fluency Skills for Technical Communication Students**

Dear Researcher:

Your research protocol was reviewed by the IRB Vice-chair on 5/22/2009. Per federal regulations, 45 CFR 46.101, your study has been determined to be **minimal risk for human subjects and exempt** from 45 CFR 46 federal regulations and further IRB review or renewal unless you later wish to add the use of identifiers or change the protocol procedures in a way that might increase risk to participants. Before making any changes to your study, call the IRB office to discuss the changes. **A change which incorporates the use of identifiers may mean the study is no longer exempt, thus requiring the submission of a new application to change the classification to expedited if the risk is still minimal.** Please submit the Termination/Final Report form when the study has been completed. All forms may be completed and submitted online at https://iris.research.ucf.edu.

The category for which exempt status has been determined for this protocol is as follows:

2. Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures, or the observation of public behavior, so long as confidentiality is maintained.
   (i) Information obtained is recorded in such a manner that the subject cannot be identified, directly or through identifiers linked to the subject, **and/or**
   (ii) Subject's responses, if known outside the research would not reasonably place the subject at risk of criminal or civil liability or be damaging to the subject's financial standing or employability or reputation.

The IRB has approved a **waiver of documentation of consent** for all subjects. Participants do not have to sign a consent form, but the IRB requires that you give participants a copy of the IRB-approved consent form, letter, information sheet. For online surveys, please advise participants to print out the consent document for their files.

All data, which may include signed consent form documents, must be retained in a locked file cabinet for a minimum of three years (six if HIPAA applies) past the completion of this research. Any links to the identification of participants should be maintained on a password-protected computer if electronic information is used. Additional requirements may be imposed by your funding agency, your department, or other entities. Access to data is limited to authorized individuals listed as key study personnel.

On behalf of Tracy Dietz, Ph.D., UCF IRB Chair, this letter is signed by:

Signature applied by Joanne Muratori on 05/22/2009 12:50:37 PM EDT

Joanne Muratori

IRB Coordinator

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