

2009

Section 508 Adherence by Industry Professionals: Improving Universal Design through Training

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Section 508 Adherence by Industry Professionals: Improving Universal
Design through Training

By

Antonio R. Rincon

A dissertation submitted in partial fulfillment of the requirements
for the degree of Doctor of Philosophy
in
Information Systems

Graduate School of Computer and Information Science
Nova Southeastern University

2009

We hereby certify that this dissertation, submitted by Antonio Rincon, conforms to acceptable standards and is fully adequate in scope and quality to fulfill the dissertation requirements for the degree of Doctoral of Philosophy.

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2009

An Abstract of a Dissertation Submitted to Nova Southeastern University in Partial
Fulfillment of the Requirements for the Degree of Doctor of Philosophy

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September 2009

Section 508 of the Rehabilitation Act Amendments of 1998 took effect in 2001 and provides encouragement for universal design and compliance requirements to the federal sector for purchases that are accessible by people with disabilities. A division of General Dynamics Advanced Information Systems (GDAIS) is located in Pittsfield, Massachusetts and provides electronic and information technology solutions to federal customers in the defense, intelligence, and homeland security communities.

The general lack of training is a major factor for low compliance to Section 508. Improving awareness is important at GDAIS in order to increase its federal sales market share, develop new products and services, transfer technology to other fields, and support a global market for users with different human conditions. The study aimed to implement a computer-based training program for design engineers and managers within GDAIS to foster universal design skills and increase accessibility awareness.

The four-level model created by Donald L. Kirkpatrick was utilized to evaluate the training. Survey, test, and interview instruments were designed to evaluate the reaction, learning, and behavior of the participants. An expert panel provided validation and reliability of the instruments. A case study methodology was used to analyze Section 508 compliance in depth for four months. Also analyzed were the possible effects of the training on the engineering design, the organization both financial and cultural, and the individual.

Learning of the standards and universal design concepts through better application of usability and accessibility features were improved. While the training did improve compliance slightly, there was a lack of Section 508 inclusion within solicitations. The organizational culture to support the disabled community showed a possibility of improving through awareness and education.

Acknowledgements

I am extremely proud and thankful to have been educated, inspired, and molded by so many wonderful people.

Dr. Gertrude Abramson, chairperson of my dissertation committee, has been a major influence on my academic career and personal growth. It is with deep respect that I express my sincere appreciation and gratitude for having such a wonderful person and knowledgeable academician as my mentor and guide. From our first meeting in late 2007, she has taken many roles in my life. Through the initial meetings and discussions with her, my dissertation idea was molded. She negotiated for me to be her dissertation student even though I did not technically belong in her academic program. Additionally, she has been an instructor, a motivator, and a strong example. Through her advice, time, and encouragement, I have grown as a student and as a person. I humorously want to state that after nearly two years with her, I will never forget that “data” are always plural. She will always be an important part of my life and I hope to continue my growth with her as a scholar and as a person.

Dr. Qi Wang, of Gallaudet University, and Dr. Ling Wang, members of my dissertation committee, played a vital part in my dissertation process. Their feedback and advice provided me with valuable guidance that has only enhanced the research. I appreciate their knowledge on the subject and for constant improvements on my work especially the methodology. For their time, energy, and dedication I cannot thank them enough.

Additionally, I would like to thank my professors in whose classes I participated during the coursework years at GSCIS: Drs. Maxine Cohen, William Hafner, Yair Levy, Marlyn Littman, Easwar Nyshadham, George Thurmond, Ling Wang, and Steven Zink. Without them, I would not have gained the necessary knowledge to succeed. I would personally like to thank the individuals who assisted me with university administration and financial matters that made my life much less hectic: Jennifer Revezzo and Eva Swinton. I would also like to thank the participants from GDAIS in Pittsfield, MA and members of the expert panel for their time and effort as well as the managers who approved and supported the research: Ronald Mauk, David Pregeluber, and David Markham.

In conclusion, I would like to dedicate my dissertation to my family whose love and affection have kept me motivated. Allison Walsh whose love has kept me focused on my dissertation. Mr. and Mrs. K who have showered me with love and kept me motivated. Kramer, Sam, and Sadie have aided me in my journey through their unwavering friendship and love. Gmoney, Kathy, Joshua, and Jacob kept me motivated through their affection and desire to see me succeed. Thank you to all my friends for their support especially Christopher Morin (Cold Dinner) and Frank Krasicki. Finally, I would like to express my gratitude for all those individuals who live life with a disability that serve as examples of strength, inclusion, and independence.

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Chapter 1

Introduction

Context

Universal design is an approach to designing information technology products and services to be accessible for all people. As per Rose and Meyer (2002), it is the creation of products that are conceived, designed, and constructed to accommodate the widest spectrum of users without the need for adaptation or specialized design. Diversity and inclusiveness must be incorporated within the design of products.

There are seven principles of universal design that apply to all disciplines including products, environments, and communications (Story, 2001): Equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. These principles direct the design process, allow for proper evaluations, and educate designers and users. Story and Mueller (2001) observe that there are many political, economical, social, and moral benefits for practicing universal design. Some of the business incentives include cost reduction and improving the quality of life of the disabled, aging, and global population.

Section 508 of the Rehabilitation Act Amendments of 1998 took effect in 2001 and provided encouragement for universal design and compliance requirements to the federal sector for purchases that must meet the accessible use of people with disabilities. Developed by a committee representing industry and disability organizations devoted to accessibility, these standards provided inclusiveness by reducing the barriers for disabled employees who utilize the technologies for communication, computing, presentation, and control (<http://www.access-board.gov/sec508/summary.htm>; Weigelt, 2007).

The setting of the research was the division of General Dynamics Advanced Information Systems (GDAIS) located in Pittsfield, Massachusetts. GDAIS was a provider of electronic and information technology (E&IT) solutions to federal customers in the defense, intelligence, and homeland security communities (<http://www.gd-ais.com/index.cfm?acronym=AboutUs>). These solutions included software for combat systems, information sharing and analysis systems, and imaging technologies. GDAIS' competitors included Lockheed Martin and Raytheon, which provided comparable services to federal agencies (<http://www.lockheedmartin.com/aboutus/index.html>; <http://www.raytheon.com/ourcompany/>). Within the Pittsfield site were approximately 800 software, system, and hardware engineers and managers of various ages, genders, and physical abilities. At this time, GDAIS did not provide nor require any training for its designers or engineering managers regarding Section 508.

Problem Statement

Section 508 required all agencies of the U.S. government through the Federal Acquisition Regulation (FAR) to ensure that any E&IT they developed, procured, maintained, or used is accessible to people with disabilities. A recent assessment by the General Services Administration (GSA) showed that the Section 508 standards were included in only 3% of the E&IT solicitations by federal agencies with a call for amending those solicitations lacking the standards (Miller, 2007). Additionally, the 3% figure did not indicate compliance as it is unclear whether a federal agency purchased a compliant product or service appropriately (Weigelt, 2007). Weigelt added that the general lack of awareness training was a major factor for low compliance to Section 508

and accessible design. Other factors included the absence of an enforcement authority, and high employee turnover in federal agencies that have experience in Section 508. A federal solicitor was an agency such as the U.S. Navy to whom federal suppliers such as GDAIS made a bid for business through a contract.

Tappuni (2001) described five major components that are necessary for a successful national effort towards universal design of products and services: political will, public awareness, guidelines and legislation, mechanisms of implementing and testing and training. Government, research, and industry/market sectors acknowledged accessibility as an imperative requirement for economic and social potential (Destounis, Garofalakis, Mavritsakis, Rigou, Sirmakessis, & Tzimas, 2004). In 1998, the U.S. government passed a major milestone for the rights of disabled individuals and the proponents of universal design with the Section 508 amendment (The Alliance for Technology Access, 2000).

Section 508 did not require companies to alter their products, but rather required products and services to meet a set of accessibility standards developed by the United States Architectural and Transportation Barriers Compliance Board [USAB] (<http://www.access-board.gov/sec508/brochure.htm>). The Federal Register listed the standards as 36 CFR Subsection 1194 defined by the USAB. Any company that would like to conduct business with the U.S. government must make products and services adhere to these standards (USAB, 2000).

The investigation was conducted at a federal supplier where the problem identified was the deficiency of implementing the standards of Section 508 into the design process. The researcher, who has worked for GDAIS for nearly 13 years, has first-

hand knowledge of the absence of training regarding the standards. The lack of literature and limited availability of training products regarding the methods and benefits of Section 508 training in the federal supplier field supported the need for further research. Choi, Yi, Law and Jacko (2006) wrote that legislation alone is not sufficient to modify the practices of design engineers. Ikeda and Takayanagi (2001) observed that education of professional designers is paramount to promoting and understanding universal design.

Goal

The goal was to implement a computer-based training program for design engineers and managers within GDAIS to foster universal design skills and increase accessibility awareness. Computer-based training (CBT) courses were available on the Section508.gov website to serve the needs of related industries and broaden compliance with Section 508 and universal design within the federal supplier industry.

Section 508 training was used to convey universal design ideas to a population of designers and managers within a federal supplier organization to increase their universal design knowledge and implement better accessibility features into their designs and process management. Ruby (2003) supported this idea by stating that a technology company that is in business with the federal government must make accessibility in its products and services a priority.

Accessibility awareness was increased within the management ranks of GDAIS so that a mechanism exists by which the organization can increase its federal sales market share, develop new products and services, transfer technology to other fields, and support a global market for users with different human conditions as per Baquis (2003), National

Council On Disability (2004) and Shneiderman (2002). Improving awareness was important at GDAIS; the U.S. government is the most important consumer of universal design products and services according to the National Council on Disability.

Research Questions

The following research questions were addressed:

1. What aspects of Section 508 compliance are relevant to engineering design for suppliers of the federal government?
2. How did the Section 508 training improve Section 508 compliance in the engineering design process?
3. What observable modifications to employee behaviors concerning universal design were anticipated following training? What occurred?
4. What results did Section 508 training produce in terms of beneficial design, organizational, informational, and financial concepts or actions such as incorporating standards in contract proposals or improving accessibility awareness within the organization?

These questions began with understanding the role of Section 508 and the effects of adhering to the standards on engineering design. It was imperative to understand the role and value of employee training in relation to Section 508 so that lessons learned from one engineering firm can be applied to other business entities in need of universal design conformity.

Relevance and Significance

Nearly eight years have passed since Section 508 of the Rehabilitation Act Amendments in 2001 became law. Federal agency compliance has not improved and new strategies are needed (Miller, 2008). Miller added that federal agencies are requesting industry assistance to alleviate the lack of compliance. The current strategy implemented by federal agencies included utilizing a software tool named the Buy Accessible Wizard. The wizard provided a list of organizations and their product evaluations, which could possibly comply with the Section 508 standards. While the products and services directory of the wizard improved Section 508 awareness, it was limited and only provided products who organizations claim are compliant. As a result, federal agencies' use of the wizard was slow.

The current base of knowledge showed a lack of any significant research on the role that Section 508 training has on compliance. Jaeger (2006) suggested that compliance could possibly increase with an educated staff of the accessibility requirements. Organizations with a knowledgeable staff would ensure that the standards are being considered during the design process. Many federal agencies have difficulty meeting the requirements due to the lack of collaboration among agency and organizational individuals that have knowledge of the standards. Section 508 education aided in collaboration, which created innovation as evident by the new video relay technology implemented and used by several employees of the Library of Congress (Bain, 2008). The deaf and hard-of-hearing individuals who use American Sign Language can now fully participate in video conferencing through the new technology as

a result of collaboration between educated members of the public and private technology industry.

Barriers and Issues

The possibility existed that participants who started the study were unable to complete it. The GDAIS facility in Pittsfield, MA was located within Berkshire County. Based on De La Mater (2009), the unemployment rate within Berkshire County was estimated to be 5.3% in January. Over the last several months, the economy has forced layoffs and other changes within the community including local companies such as Sabic and KB Toys. Members of the corporate management indicated that there is no plan for the organization to make changes but the possibility existed. Only one participant who completed the survey and test was laid off but his interview data was collected over the phone rather than face-to-face. Additionally, a large enough population was studied to ensure that any participant removal would not jeopardize the investigation.

Participants took the training on their own time, not within the workday. Organizations that implemented online training courses face high dropout rates because trainees were unable to self motivate or became lazy (Long, DuBois, & Faley 2008). While there was no guarantee of completion of training, constant encouragement and words of appreciation provided motivation. In this investigation, emails were sent to participants thanking them for taking the training and completing the survey and tests.

Limitations and Delimitations

Two limitations had the potential to affect the results. First, even though the participants agreed to participate, fidelity and honesty in reporting can lower the anticipated percentage of completed training or returned surveys and tests. The number of participants that completed the training and provided data met the recommendations as per Gay and Airasian (2003), and Leedy and Ormrod (2005). Second, the organization was becoming more interested in Section 508 and accessibility. As a result, participant behavioral changes could be the result of training received or experiences beyond the scope of the study. All the participants stated that they did not experience or receive any training related to Section 508 and accessibility.

Delimitations are factors controlled by the researcher that will clarify boundaries and narrow the scope (Roberts, 2004). Several delimitations were imposed. First, data collection was conducted between April 2009 through July 2009 at the GDAIS facility located in Pittsfield, MA. Second, the sample of 30 to 40 participants consisted only of managers, procurement engineers, administrative assistants, quality assurance engineers, hardware engineers, web technology engineers, and software designers. Third, the selected training courses used by the participants were located at the Section508.gov website modified last on April 30, 2008. As anticipated, the results of the investigation are valuable to other engineering facilities working to comply with government accessibility requirements.

Definitions and Acronyms

Accessibility - Accessibility provides equal access to individuals regardless of any human factor such as physical ability, economic situation, cognitive skills, or literacy skill (Destounis, Garofalakis, Mavritsakis, Rigou, Sirmakessis, & Tzimas, 2004).

ACM - Association for Computing Machinery is a professional organization that provides an approach to performing work according to certain values important for business and society (Payne & Landry, 2006).

ADA - Americans with Disabilities Act is legislation that provides usability criteria but its scope is limited to various information technologies and software (Story, 2001).

ASTD - American Society for Training and Development is an association devoted to the maximum development and utilization of human potential through learning (Rossett, 2007).

Buy Accessible Wizard - The Buy Accessible Wizard is a software tool found on the Section508.gov website that provides a list of organizations and their product evaluations compared against Section 508 compliance (Author, 2008).

CSI - Customer Satisfaction Index is a number used to evaluate customer satisfaction as related to profit regarding their products (Karimi, Somers, & Gupta, 2001).

Disabled Individual - A person who is limited in performing activities due to a physical or mental aspect (Romano, 2003).

E&IT - Electronic and Information Technology include computer systems, operating systems, and websites that must meet Section 508 compliance when procured, maintained, and developed by federal agencies (USAB, 2000).

FAR - Federal Acquisition Regulation is the set of official government regulations, which incorporate the Section 508 standards (USAB, 2000).

Federal Agency - Any federal department or agency such as the United States Postal Service (USAB, 2001).

Federal Solicitor - A federal agency to whom federal suppliers make a bid for business through a contract (Author, 2008).

GDAIS - General Dynamics Advanced Information Systems is an organization that provides electronic and information technology solutions to federal customers in the defense, intelligence, and homeland security communities (<http://www.gd-ais.com/index.cfm?acronym=AboutUs>).

GSA - General Services Administration administers contracts for the federal government through the federal supply service (http://www.gd-ais.com/index.cfm?acronym=gsa_aisit).

GUI - Graphical User Interface allows users to interact with the functionality of computer applications (Harper, 2007).

ICCP - Institute of Certification of IT Professionals is a professional organization that provides an approach to performing work according to certain values important for business and society (Payne & Landry, 2006).

IEEE - Institute of Electrical and Electronics Engineers consists of members that develop De jure standards used by software and website engineers (<http://standards.ieee.org>).

ISO - International Organization for Standardization is an official regulatory agency that forms De jure standards (Wang & Kim, 2007).

ITAA - Information Technology Association of America is a professional association that provides an approach to performing work according to certain values important for business and society (Payne & Landry, 2006).

Section 508 - Section of the accessibility standards added in 2001 to the Rehabilitation Act Amendments of 1998 (Weigelt, 2007).

Self Contained, Closed Products - Products that have embedded software and are commonly designed that a user cannot easily attach or install assistive technology (USAB, 2001).

SIN - Special Item Numbers are numbers used by the GSA that describes a specific product, service, or solution along with a list of contractors that satisfies the needed requirements of a federal solicitor (Author, 2008).

Smile Sheet - A set of questions asked of participants for immediate reaction to a training course (Weinstein, 2007).

Standard - A group of specifications, to which, a product, process, or procedure must conform (Wang & Kim, 2007).

TEITAC - The Electronic and Information Technology Advisory Committee is composed of federal, industry, and public members representing the interests of the disabled community. They support the Access Board by providing suggestions for revising and updating the Section 508 guidelines (USAB, 2006).

TTY - Telephone Typewriter is a device that allows text communication over a telephone line through a keyboard (USAB, 2000).

Undue Burden - An action that would result in significant difficulty or expense for a federal contractor to meet Section 508 compliance (USAB, 2000).

Universal Design - The creation of products that are conceived, designed, and constructed to accommodate the widest spectrum of users without the need for adaptation or specialized design (Rose & Meyer, 2002).

USAB - United States Architectural and Transportation Barriers Compliance Board are consumer representatives of federal E&IT and developed the Section 508 standards between August 1998 and March 2000 (USAB, 2000).

VPAT - Voluntary Product Accessibility Template is a document created by an organization that provides a description of how their products and services meet the Section 508 standards (National Council On Disability, 2004).

W3C - World Wide Web Consortium consists of members that develop interoperable technologies used by software and website engineers (<http://www.w3.org/>).

Organization of the Study

The second chapter contains a review of current and relevant literature, which serves as the theoretical foundation. The framework was formulated by understanding the value of accessibility and universal design to business and society. The ideas and theories discussed in the literature are broken down into several important relevant topics, which support the value of universal design and accessibility.

The third chapter contains the methods by which the research questions were answered to meet the goal. The chapter begins with a discussion of the case study design to be employed. Yin (2004) supported the research design of a case study for those involving government actions at the federal level. The chapter continues with a discussion of the training instrument used followed by the selection process for the

participant pool. Descriptions of the data collection approach for each individual research question follow. The chapter concludes with the resources that were needed.

Chapter 2

Review of the Literature

Overview

The literature review focused on several fields of work that served as a foundation for the investigation regarding Section 508 and universal design. The current body of knowledge supported the significant role of universal access within information technologies and the need to design products that disabled individuals can access as efficiently as those without disabilities (Gellenbeck, 2005; Reed, Gardner-Bonneau, Isensee, 2004). Several factors within the literature are driving the importance of accessibility and universal design to business and society. Within the engineering profession, there is a professional, social, and moral responsibility to adhere to standards and code of conducts by respected technology associations.

These standards include accessibility awareness and universal design features that are widely accepted by engineering associations. In addition to these general engineering design standards and codes, Section 508 is a government regulation that applies within the federal supplier field. Along with understanding industry and Section 508 regulations, it is necessary to recognize their business implications. A discussion will focus on the role that training and training evaluation have on satisfying standard compliance and educating universal design. In conclusion, a description will be provided regarding how the GDAIS organization encounters the need for Section 508 compliance through its contracts.

Design Standards for Engineers

Reed, Gardner-Bonneau and Isensee (2004) wrote that there are many resources available to product developers searching for guidance on design. These resources include books, guidelines, and standards. While books and guidelines provide general guidance, they are the least formal source, lack detail, and commonly represent only one organization's opinion. Standards undergo extensive documented development by organizations and individuals through a building process guaranteeing consensus among all affected.

A standard is a group of specifications, to which, a product, process, or procedure must conform (Wang & Kim, 2007). Wang and Kim state that standards provide several functions: a) specifying an acceptable product whose defining features include safety, performance, or efficiency; b) providing assistance in evaluating a product whose attributes become valuable scientific information and; c) identifying the properties of a product for proper functionality which could lead to innovations.

The formation of a standard is a development process by two distinct stakeholders within a given industry. One stakeholder includes members of the market such as producers, suppliers, consumers, and engineers while the second includes the government and its entities. Establishing a standard depends on its attributes as well as the strategies of the stakeholders. The attributes of a standard include its level of detail within current network, hardware, and software technology, and its timeliness in addressing technical development. Wang and Kim (2007) state that the standardization process produces de facto and de jure standards. De facto standards are formed by a single organization or a strategic alliance of many organizations in support of the marketplace. De facto standards

are voluntary standards created by the product market guided by directly interested stakeholders.

De jure standards are formed by official regulatory agencies such as the federal government or the International Organization for Standardization (ISO) who have some regulatory authority. They are technical regulations usually mandated by law and recommendation that have a higher quality than de facto standards but take longer to develop (Wang & Kim, 2007). Common de jure standards used by software and website engineers include those approved by the Institute of Electrical and Electronics Engineers (IEEE) Standards Association and the World Wide Web Consortium (W3C) (<http://standards.ieee.org/>; <http://www.w3.org/>).

Compliance to standards by engineers and designers are required by the profession's codes of conduct (Gellenbeck, 2005). Additionally, codes of conduct require the obedience of all engineering laws, consideration of disability issues, and volunteering expertise to the education of others and the public. There are several engineering codes of conduct developed by professional organizations; each provides an approach to performing work according to certain values important for business and society (Payne & Landry, 2006). These organizations include the Association for Computing Machinery (ACM), the Institute of Certification of IT Professionals (ICCP), and the Information Technology Association of America (ITAA).

Payne and Landry (2006) introduced a uniform code of conduct with three principles consisting of seven values: consistency, respect for individuals, autonomy for all, integrity, justice, utility, and competence. The first principle discussed treating all constituents fairly and respectfully, and sharing all information equally. By following it,

engineers provide all shareholders with information that is accurate and complete, which results in a high-quality product. In order to adhere to the first principle, all members of the engineering discipline should uphold their ethical principles and work with others in the field with honesty and respect.

The second principle stated that all decisions in the design process should be made with integrity and equality. By following it, design engineers ensure that all confidential information of their employer remain guarded while completing all tasks to the best of their abilities. Additionally, Payne and Landry (2006) state that design engineers must refrain from using their knowledge in a manner to advance their own careers, which only creates distrust between the design engineer, the employer, and the consumer of the products.

The third principle stated that the utility and competence of a project should be assessed according to social and individual needs. By following it, design engineers constantly evaluate the impact of every decision made to remove any unequal effects on all involved parties. Additionally, competence of design engineers provides the best opportunity for an equal product by maintaining state-of-the-art knowledge in the field (Payne & Landry, 2006). While there are many codes of conduct, they all stress that design engineers have an obligation to consider and include features that meet standards to increase accessibility of products through universal design.

Universal Design: Section 508 Standards

The creation of standards by the federal government provides several advantages over de facto standardization (Wang & Kim, 2007). The amount of time a standard is

created through the government process is usually significantly less when compared to the process within an extremely competitive market with a few dominant organizations and many small ones. Second, government creation of standards reinforces the use of the correct technology to meet product specifications for all users. Third, government creation of standards increases the possibility of technology innovation. Through the government's ability to invest in research and facilitate cooperation between large, complex, and diverse technological interests, the possibility of innovative products increases. Last, the government provides a centralized setting to reduce the disregard of certain users within nonstandard technology during the creation of standards. The centralized setting of government standardization provides an avenue for infusing universal design within government standards such as Section 508.

The Section 508 standards were created as de jure standards to allow all users the ability to utilize government products and services regardless of abilities (Weigelt, 2007). The creation of the Section 508 standards is a vital step within the process of applying universal design to a specific environment such as federal solicitors to the government. Burgstahler (2009) described the eight-step process used for applying universal design to environments such as instruction and worksites. The following passages describe each of the steps as supported by the USAB (2000).

The first step in applying universal design is to identify the application.

The identification involves specifying the environment or product the principles of universal design will be applied. In 1998, the President of the United States signed into the law the Workforce Investment Act of 1998, which includes the Rehabilitation Act Amendments of 1998. Section 508 of these amendments

required an independent federal agency known as the United States Access Board to publish accessibility standards for federal agencies responsible for the development, procurement, and maintenance of E&IT.

The second step involves defining the users of the application including their diverse characteristics. The USAB defines the users of government E&IT as all federal employees and members of the public with disabilities such as hard-of-hearing and the blind who have equal access to all information and data as those without disabilities.

The third step of applying universal design is to involve consumers during development, implementation, and evaluation. The members of the USAB represent the consumers of federal E&IT, which consists of 25 industry representatives with 13 required to have a disability and the other 12 required to be high-ranking executives of federal agencies such as the departments of Education, Labor, and Defense. The members of the USAB developed the standards between August 1998 and March 2000. In March 2000, the proposed standards were open to the public for comment and evaluation. Over a 60-day period, comments were submitted to the USAB from federal agencies, disability groups, and persons with disabilities. Consumer involvement not only during the public comment period but also as members of the USAB satisfies the third step of applying universal design.

The fourth and fifth steps of applying universal design are to create and apply a standard that is integrated with universal design principles. The final Section 508 standard formally added in February 2001 implements many

guidelines utilized by the industry at that time for the disabled including the 1.0 guidelines of the W3C, Americans with Disabilities Act (ADA) Accessibility Guidelines, and the Telecommunications Act Accessibility Guidelines.

The sixth step is to provide a process by which user requests can be addressed who cannot access the E&IT products. Within the Section 508 FAR, the USAB states that each federal agency is to have a Section 508 coordinator to assist not only the agency but also others with certain requests. Additionally, users may file a complaint or seek civil action to mandate compliance.

The seventh step of applying universal design is to provide training regarding the material, which allows for awareness and inclusion (Burgstahler, 2009). The USAB provides training through courses on their Section 508 website.

The final step of applying universal design to a product or environment is to conduct constant evaluation. Burgstahler (2009) adds that an evaluation provides a periodic assessment by users through feedback for potential improvement and modifications. According to its charter, the Telecommunications and Electronic and Information Technology Advisory Committee (TEITAC) provides suggestions for revising and updating the guidelines (USAB, 2006). The TEITAC is composed of federal, industry, and public members representing the interests of the disabled community. Additionally, any future updates to the Section 508 standard are open to a public comment period similar to the one conducted in 2000.

The Section 508 standards, presented in Table 1 below, were defined through four subparts: general (subpart A), technical standards (subpart B), functional performance

criteria (subpart C), and information, documentation, and support (subpart D) (USAB, 2000).

Table 1. List of Section 508 Standards

Standard Title	Sub part	Section Number	Section Title	Definition
General	A	1194.1	Purpose	States the purpose of the standards
		1194.2	Applications	Defines aspects of the standards
		1194.3	General Exceptions	States the six exceptions to meeting the standards
		1194.4	Definitions	Defines a list of terms
		1194.5	Equivalent Facilitation	Allows for alternative technologies
Technical Standards	B	1194.21	Software Applications and Operating Systems	Twelve rules for software usability
		1194.22	Web Based Intranet and Internet Information and Applications	Sixteen rules to create web technology
		1194.23	Telecommunications Products	Eleven rules for compatibility with assistive devices
		1194.24	Video or Multimedia Products	Five rules for accessibility to video and multimedia products
		1194.25	Self Contained, Closed Products	Eleven rules for using a product without an attached assistive device
		1194.26	Desktop and Portal Computers	Four rules for accessible computer systems and components
Functional Performance Criteria	C	1194.31	Functional performance criteria	Six rules for a product whose components are not accessible
Information, Documentation, and Support	D	1194.41	Information, documentation, and support	Three rules governing access to documentation and support

Note. From "Section 508 standards," retrieved August 22, 2008, from

<http://www.section508.gov/index.cfm?FuseAction=Content&ID=12>.

Subpart A contained five sections listed as purpose (1194.1), applications (1194.2), general exceptions (1194.3), definitions (1194.4), and equivalent facilitation (1194.5). The purpose section explained that the standards define the types of technology and provide a level of accessibility. The applications section described the scope of the standards as they relate to E&IT in the federal sector. The general exceptions section stated the reasons for contractors not to meet the standards including undue burden or national security. The definitions section of Subpart A listed terms associated with the subject matter such as accessible and undue burden. The final section of Subpart A is equivalent facilitation, which stated that alternative technologies that do not meet accessibility standards but whose use results in access for disabled individuals are allowed (USAB, 2000;

<http://www.section508.gov/index.cfm?FuseAction=Content&ID=12>).

Subpart B contained five sections listed as software applications and operating systems (1194.21), web-based intranet and internet information and applications (1194.22), telecommunications products (1194.23), video and multimedia products (1194.24), self contained, closed products (1194.25), and desktop and portable computers (1194.26) (USAB, 2000;

<http://www.section508.gov/index.cfm?FuseAction=Content&ID=12>). The rules defined in section 1194.21 provided designers with 12 provisions that are essential in the design of telecommunications products that have software applications and operating systems. The design should provide software with functions discerned textually and controlled through a keyboard without disrupting activated accessibility features. For example, a software program that provides a command to print needs to be invoked through the

keyboard. For users who cannot accurately control a mouse, keyboard functionality is essential to control the software. Additionally, the software functions should not disrupt any activated accessibility features such as how large textual information is displayed on the monitor. Changing activated accessibility features could cause the computer system to become inaccessible to a user (USAB, 2000).

Additional rules in section 1194.21 stated that the design of telecommunications products with software should provide users with a clear on-screen indication of the current focus without the use of high frequency blinking. The use of the focus allowed for assistive technology such as screen readers to be used. High frequency blinking could cause the trigger of seizures to those with photosensitive epilepsy. Designers should provide textual information for all images, color coding, or animations. With textual representation, users of assistive technology can access these important elements. Finally, the design of all fields, functionality, and information of electronic forms should be made accessible to all users including those utilizing assistive devices (USAB, 2000).

The rules defined in section 1194.22 provided designers with 16 provisions that are essential in the design of web-based intranet and internet information and applications. The design of webpages that utilize non-text elements such as images, site maps, or frames should provide a textual equivalent. Similarly, textual representation should be used for screen elements or controls that use color. For example, a navigational image on a webpage such as a red “go back” arrow button needs to be accompanied with actual text of the image’s purpose. Users without sight are able to access webpages through the textual representation of the navigational image (USAB, 2000).

Additional rules in section 1194.22 stated that designers of webpages must ensure the readability of any documents regardless of the browser used. Readable documents are created by creating tags within the webpage code to control font-size and boldface. Controlling font-size and boldface allows documents to remain consistent from one browser to another and accessible to all users. Designers also need to code tables within a webpage appropriately to allow consistent display from browser to browser. Designers must enforce the rules of software applications when they utilize embedded software in their webpages including applets and plug-ins. For example, a webpage that is embedded with a video applet such as Google Video, the designer must ensure that the applet can be used by the keyboard, with a low blinking rate, and provide supporting textual information. Webpage designers must provide the ability for users to skip repetitive navigation links, which makes the tracking of page content extremely difficult for users with speech readers. Finally, electronic forms need to be made accessible with the proper focus and the allotment of additional time for their completion (USAB, 2000).

The rules defined in section 1194.23 provided designers with 11 provisions that ensure the design of telecommunications products that allow voice communication such as cell phones or conferencing software are compatible with the devices of the hearing impaired. Designers must provide either telephone typewriter (TTY) functionality or a connection point for TTYs in their products that allow voice communication. A TTY is a device that allows text communication over a telephone line through a keyboard. Similarly, designers must allow any functions such as voice mail and caller identification to be usable by TTY users. Designers need to provide adjustable volume and output that can be used by wireless hearing technologies with the lowest possible interference.

Additionally, any mechanically operated controls or keys of the voice communication product shall be tactilely and visually discernible and operable with one hand. These provisions provide users of TTYs or hearing technologies equal accessibility to voice communication products and their features (USAB, 2000).

The rules defined in section 1194.24 provided designers with five provisions that make certain video hardware, video programs, or video presentations are accessible by the hard of hearing. Designers need to provide the capacity for decoding and displaying of captioning for audio material whether displayed on a television or computer equipment. Additionally, designers of telecommunication products with television tuners must be able to provide a secondary audio track for audio description. Finally, designers whose products utilize multimedia presentations such as training or conferences must provide an audio description of visual material. The USAB highlights that subtitles are not an effective substitute for captioning since subtitles do not display descriptions of sounds or music, which provide better understanding of the dialogue. The provisions provide individuals who are hard of hearing to receive the same information of the multimedia as nondisabled individuals (USAB, 2000).

The rules defined in section 1194.25 provided designers with 11 provisions that are essential in the design of self contained, closed products. A self-contained, closed product contains embedded software that a user cannot easily attach an assistive device such as a joystick. These products include fax machines, printers, information transaction machines, and others. Designers of these telecommunication products must build in accessibility features according to those rules in 1194.21 for software and operating systems including allowing additional time to complete tasks, limited blinking, and

textual representation of images. For designers of these products that utilize touchscreens, mechanically operated controls must be provided that are tactilely discernible and operable with one hand. If these closed products contain a security feature through biometric controls such as fingerprints, the designer must utilize a non-biometric alternative such as typing or speaking a given password. Finally, designers of self contained, closed products must ensure that all provided audio output be used with standard audio processing devices such as headphones and provide volume control (USAB, 2000).

The rules defined in the final section 1194.26 of Subpart B provided designers of desktop and portable computers with four provisions. In contrast to the rules in 1194.21, which discuss accessibility of software that runs on a computer system, the provisions of 1194.26 dealt with the physical characteristics of computer systems. These characteristics included the design of controls and connectors found within the hardware of desktop and portable computers. Hardware designers must ensure that all mechanically operated controls or keyboards of these products are tactilely discernible and operable with one hand. Additionally, if the computers utilize touchscreens or use biometrics, alternative accessible forms or controls must be provided. Finally, designers of desktop and portable computers must provide standard ports and connections that are usable with assistive technology. These rules provide equal access to keyboards, computer connections, and touchscreens of desktop and portable computers (USAB, 2000).

Subpart C contained one section listed as functional performance criteria (1194.31). The rules defined in section 1194.31 provided six provisions for designers of telecommunications products whose technologies or individual components do not meet

any of the technical standards of Subpart B. The USAB (2000) added that the provisions ensure that individual accessible components work together in the creation of an accessible product. Designers of such telecommunication products needed to provide a mode of operation where the output can be interpreted audibly through screen readers or Braille displays as well as textually through captioning. Additionally, the telecommunication products must be able to allow the change of font and color. Finally, the design of these products must include an alternative method for users when required to provide speech input or use fine motor control.

Subpart D contained one section listed as information, documentation, and support (1194.41). The rules defined in section 1194.41 provided designers of all E&IT products with three provisions. For any product to be fully usable, the designers needed to provide documentation and support services that are accessible to all users. Designers needed to include information about accessibility features of their products in the documentation. The documentation must also be available in alternative formats when requested such as in Braille. Finally, those designers who assisted with supporting the product must use a help system that can support various communication needs such as TTYs (USAB, 2000;

<http://www.section508.gov/index.cfm?FuseAction=Content&ID=12>).

Principles of Universal Design

The rules found within the subparts of the Section 508 standards use the principles of universal design. Designers that implement the Section 508 rules into their designs create products that are accessible to federal employees and members of the

public with or without disabilities (USAB, 2000). According to Story (2001) and Story and Mueller (2001) there are seven principles of universal design and the following passages describe each of the principles.

The first principle is equitable use, which provides a design that is useful to individuals with diverse abilities. All the subparts of the Section 508 standard include rules for designers of E&IT products and their documentation to be of equitable use. These rules include designing software, operating systems, websites, computers, and documentation whose features can be used by diverse users.

The second principle is flexibility in use, which provides a design that accommodates a wide range of individual preferences and abilities. All the subparts of the Section 508 standards include rules for providing flexibility, which include providing alternative methods of accessing the functions and information of the products.

The third principle is simple and intuitive use, which defines the use of a product as easy to understand regardless of experience or knowledge. The provisions within the Section 508 standard demand that the design of E&IT products include features and functionality that are clear and useful (USAB, 2000).

The fourth principle is perceptible information that provides a design where its information is communicated effectively to diverse users. All the subparts of the Section 508 standard include rules for representing information in textual and audio format including captioning.

The fifth principle is tolerance for error, which provides a design that limits the amount of unintentional actions a user can commit. All the subparts within the Section 508 standard include mechanisms to minimize user error including allowing additional time to complete tasks or providing alternative methods of functionality that are commonly used by disabled users.

The sixth principle is low physical effort that provides a design that can be used comfortably and with minimal fatigue. Many of the subparts of the Section 508 standards provide rules to designers for applying a comfortable environment. These rules include providing alternative methods of functionality that are more comfortable to diverse users. Additionally, the rules include providing hardware options that diverse users can utilize such as assistive technology devices including keyboards and TTYs.

The seventh principle is size and space for approach and use. The principle is defined as providing a design where users with different mobility can use the products with appropriate reach and manipulation. Several of the subparts of the Section 508 standard include rules for designers that support the principle. Designers must provide alternative means of utilizing functionality especially if using biometric controls or touchscreens. These alternative means provide users with various posture or mobility to utilize the E&IT products equally.

An E&IT product must meet accessibility standards defined within Section 508 by the federal government (Gellenbeck, 2005; Keates, 2006; National Council on Disability, 2004; Rosmaita, 2006). The application of accessibility standards provides usability as well as the demand for consistency among designers (Regan, 2004).

Additionally, designers must incorporate practices and standards into their work to be consistent with other designers whose work they admire. Although the Section 508 enforcement and the role of litigation remains unclear, organizations whose designers do not follow the Section 508 standards leave themselves vulnerable to complaints and civil actions (Reed, et al., 2004).

Business Impacts of Universal Design

From the point of view of computer and software systems, all human users have varied skills. Users of computer interfaces vary from novice to power user, which demand accessibility to eliminate any barriers (Destounis, et al., 2004). Market forces influence the increasing role that universal design and accessibility standards have on an organization (Keates, 2006; Rosmaita, 2006). Many in the governmental, research, and industrial sectors including Microsoft, Sun Microsystems, and the Trace Research and Development Centre have acknowledged the requirement of accessibility within the design of products (Destounis, et al).

Organizations are beginning to realize the growing population of disabled individuals and the potential employment issues and market gains (Destounis, et al., 2004). One in five Americans has a disability and one in 10 has a severe disability (Gellenbeck, 2005). In addition, there is a rapid rise in the number of older people over the age of 65. In 2004, the population was 30 million but estimates by 2020 place the population will be nearly 50 million, which will be nearly 22% of the United States population (Reed, et al., 2004). Destounis, et al. (2004), state that over half of those over

the age of 65 face one or more functional limitations and that number continues to increase.

Accessible technology allows for an increase in profit from an untapped market of potential customers of over 750 million people worldwide and 54 million in the United States (Romano, 2003). Additionally, with current and advancing medical technology, over 5.2 million U.S. children and teenagers survive and live with a disability and will go on to become adult consumers (Loiacono, 2004). Only 25% of disabled individuals own computer systems while only 10% have ever used the Internet. Romano adds that this number is changing rapidly as disabled individuals are demanding more accessible computer systems and web-based resources. Loiacono states that as the affluent middle-aged population grows older and declines in physical mobility, accessible web-based resources are becoming more attractive.

Reed, et al. (2004) estimated that nearly 66% of disabled adults between 21 and 64 are unemployed with a 44% unemployment rate of disabled individuals that are able and available to work. They suggested that with accessible E&IT, this pool of potential employees would provide personal, social, and economic benefits to an organization. More importantly, as the current employee base of an organization ages, there is a high possibility that functional limitations will limit their productivity (Keates, 2006). These issues provided a compelling case for accessibility in information technology.

Organizations rely also on improving their customer satisfaction index (CSI). A 1-point increase corresponds to an average of over \$240 million increase in market value (Karimi, Somers, & Gupta, 2001). Organizations attempt to improve customer satisfaction by improving their product and service quality, which enhances user

convenience and productivity. Romano (2002) stated that companies dedicated to improving their customer relationships were almost 7% more productive than their competitors. Karimi, et al. added that providing easier access to accurate in-depth information is a mechanism many organizations use to improve customer service. By improving the accessibility of information and products available, disabled customers could influence and improve the CSI. Organizations are also realizing that adding accessibility to their products enhances their corporate image that lead to increased market share and profitability (Loiacono, 2004).

There are tremendous benefits to the consumers of organizations when accessibility features are implemented in their products. Gellenbeck (2005) reported that 57% of computer users benefit from accessible technology whether disabled or not. Universally designed products increase usability for all consumers (Reed, et al., 2004; Rose & Meyer, 2002). For example, Rose and Meyer stated that captioning once used only for those with hearing difficulties are now widely beneficial in noisy health clubs and restaurants. Destounis, et al., (2004) added that universally designed keyboards provide the same functionality to those users with missing limbs as well as to a user who is recovering from a broken wrist. Additional benefits to end users and employees include the increase in productivity, the reduction of mental and physical stress, and the improvement of interoperability and consistency across applications and products (Reed, et al., 2004).

Compliance Training and Evaluation

Training is a valuable step in the process of applying and adopting universal design to a given environment. The lack of any training in accessibility philosophies causes designers to design products for the able-bodied market (Keates, 2006). Designers achieve accessibility through two methods: by designing products that are compatible with assistive technologies and by designing universally accessible products without any use of assistive technology (Gellenbeck, 2005). Designers become more comfortable with unfamiliar standards and the universal design process through training (Regan, 2004).

The learning process for designers needs to be experiential since accessibility consists of complicated concepts and ideas unfamiliar to common able-bodied designers. Regan (2004) stated that designers constantly need to improve their understanding of accessibility and design through voicing their concerns regarding accessibility standards and that learning universal design is a constant active process of ongoing training, studying standards, and reinforcing concepts. Carter and Fourney (2007) stressed that effective training focuses on disability issues, standards and guidelines, and accessibility tools for implementation. Properly trained designers design for the wants, needs, and aspirations of diverse users (Keates, 2006). Reed, et al., (2004) added that the reduction of training expenses is a benefit of training that adheres to accessibility guidelines.

Training should be tailored to provide the best practices in an effort to create an environment of inclusiveness and accessibility (Keates, 2006). Keates affirmed proper accessibility training begins with understanding information about the consumer base to design products that are socially and practically acceptable. A socially acceptable product satisfies the requirements and wants of the end user. Designers need to be trained through

information about or exposure to disabled users when they consider designing for such a diverse user base. A practically acceptable product performs its functions with reliability and usefulness. Keates stated that training designers to create practical products for disabled users is not different from the typical design process. Rather, designers needed to be trained to apply sensitivity to their functional requirements to make products more efficient and easier to use.

Over 50 years ago, Donald L. Kirkpatrick created a model to evaluate training, which has become widely accepted and highly regarded amongst industry experts (Haupt & Blignaut, 2007). J. Kirkpatrick (2007) affirmed that as a new application, the Kirkpatrick model was used to ensure employee learning for compliance purposes. There are four levels in the Kirkpatrick model, which are defined as reaction, learning, behavior, and results. Haupt and Blignaut (2007) suggested that Kirkpatrick's four-level model be implemented in qualitative rather than quantitative research to evaluate a training program. There are several reasons for evaluating a training program, which align to the individual levels (Kirkpatrick, J., 2007; Rossett, 2007).

Level 1 focused on how employees view the value of the training as related to their responsibilities in order to determine the relevance of the material in the workplace. Receiving feedback from the trainees allows the training to be modified and enhanced for better future results. Relevant feedback is critical when teaching skills as it connects the trainees to the purpose of learning (Rose & Meyer, 2002). D. L. Kirkpatrick (2007) and Rossett (2007) added that properly measuring the immediate reaction and satisfaction creates a positive attitude of the training knowledge, which becomes reinforced during work activities.

Level 2 focused on evaluating the knowledge learned, skills developed, and attitudes changed as a result of the training (Kirkpatrick, D. L., 2007). Evaluating the learning is important for measuring the effectiveness of the training material in increasing knowledge or changing behaviors through setting clear goals. Proper goals assist in understanding the true purpose of the training and what is needed of the learners for success of the program (Rose & Meyer, 2002). D. L. Kirkpatrick stressed that without learning there is little to no opportunity to change behavior, which is a keystone for training.

Level 3 focused on how the training material affects behavior in order to validate the expectations of the training. Understanding changes in behavior, which take time, highlight the success or failure of the goals of the training. D. L. Kirkpatrick (2007) stated that training causes behavior changes in three ways. First, the trainee who enjoyed the training and understood its goals will continue the expected behavior changes. Second, the trainee who did not understand or enjoy training will return to his old behavior. Third, the trainee who changed his behavior but certain constraints such as time will prevent him from continuing it. J. Kirkpatrick (2007) added that these changes in behavior provide better understanding of the alignment of an organization's business strategy with its instructional design.

Level 4 focused on the benefit to the organization in order to measure the value of the training. The American Society for Training and Development (ASTD) reported that 94% of training courses are evaluated for Level 1, 34% for Level 2, 13% for Level 3 and only 3% for Level 4 (Rossett, 2007). Weinstein (2007) wrote that Level 4 evaluation is typically conducted to analyze the financial impact or return on investment of the training

to the organization which can be time consuming and costly to the organization.

Alternatively, financial numbers are not the only indicators of business effectiveness because of training (Haupt & Blignaut, 2007; Spitzer, 1999). Other indicators are more organizational specific such as manufacturing efficiency, inventory levels, increased quality, and in the given research the reduction of barriers to accessibility.

Procuring Government Contracts by GDAIS

The importance of describing the process by which GDAIS conducted business with the agencies of the federal government is paramount to supporting training for Section 508. The process showed the manner in which the organization is required to implement the Section 508 standards in its product design regardless if agencies do not specifically place them in their requirements. The process also highlighted that product designers of GDAIS must understand universal design which is the foundation of Section 508.

GDAIS obtained government contracts through a contract administered by the Federal Supply Service of the United States General Services Administration (GSA) (http://www.gd-ais.com/index.cfm?acronym=gsa_aisit). The contract, GSA Schedule 70, provided assistance to government agencies seeking procurement of electronic and information technology, services and solutions through the definition of 14 Special Item Numbers (SINs) (http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_OVERVIEW&contentId=8661&noc=T). Each SIN described a specific product, service, or solution along with a list of contractors that satisfies the needed requirements of a federal solicitor.

For example, the SIN categorized as 132-51 with a title of Information Technology Services describes information technology equipment, software, and services needed for resource management, systems design, and network services along with a list of contractors who can provide the needed information technology (<http://www.gsaelibrary.gsa.gov/ElibMain/SinDetails?executeQuery=YES&scheduleNumber=70&flag=&filter=&specialItemNumber=132+51>). A second SIN categorized as 132-50 with a title of Classroom Training describes information technology equipment, software, and services needed for staff training along with a list of contractors who can provide the needed information technology (http://www.gsa.gov/Portal/gsa/ep/contentView.do?contentType=GSA_OVERVIEW&contentId=8661&noc=T).

Procurement officials within GSA handled procurement but many of the federal solicitations only included references to Section 508 rather than articulated the specific standards (Miller, 2007). Additionally, if required, a solicited contractor bidding for a proposal might produce supporting accessibility documents such as the voluntary product accessibility template (VPAT), a document that provides a description of how the solicited products and services meet accessibility standards of Section 508 (National Council On Disability, 2004).

Relationship of Literature to the Study

The investigation focused on Section 508 training for an organization whose business is with the federal government. Section 508 training taught ideas of universal design such as equitable and flexible use but also highlighted the responsibility of

engineers to design with equal access for users. The training is required by law and provided an avenue for improving business process and showing a possibility of enhancing streams of revenue with innovation and new customers.

The process developed for training Section 508 standards and evaluating its effectiveness for engineers included using CBT training materials on the Section508.gov website and evaluation following the model of D. L. Kirkpatrick. While the process was designed for a small population within a specific firm, it may be applied to current organizations with federal contracts and to other organizations who would like to enter the federal contractor field. Additionally, it served as a foundation for training and evaluation of standards that implemented accessibility and universal design ideas.

Chapter 3

Methodology

Restatement of the Problem and Proposed Solution

In 2001, Section 508 became law to promote and mandate accessibility features based on universal design. By 2007, only 20% of all proposals to federal agencies mentioned accessibility requirements (Miller, 2008). Organizations that conduct business with federal agencies are required to adhere to Section 508 standards even if not directly requested. Education through training can potentially remedy the problem of implementing the standards of Section 508 into the design process. The absence of training regarding the standards was evident within the Pittsfield, MA engineering group of GDAIS. Ikeda and Takayanagi (2001) observed that education of professional designers is paramount to promoting and understanding universal design. The investigation implemented a computer-based training program for design engineers and managers within GDAIS. The CBT courses found on the Section508.gov website were used to foster universal design skills and increase accessibility awareness.

Research Design

Leedy and Ormrod (2005) stated that qualitative research designs serve several purposes such as description, interpretation, and evaluation. Yin (2006) wrote that the strength of a case study is served when analyzing a case within a real life context. Both Leedy and Ormrod, and Yin maintained that the method is pertinent when a greater understanding of a given situation, event, or people is needed over a certain period.

Additionally, a general purpose was to gain better understanding of a little known area such as the effect of Section 508 training on engineering design.

Case study methods evaluate the effectiveness of particular policies and practices. Furthermore, the issues regarding the phenomenon are interpreted and new insight and concepts are obtained (Leedy & Ormrod, 2005; Yin, 2004). Yin wrote that the findings can be significant for other applications and can provide great theoretic value for a given field. The method is not limited to any single type of data either qualitative or quantitative. Data may be collected through multiple sources such as surveys, literature, observations, and interviews. A strong study provides both qualitative and quantitative data pointing to the same conclusions also known as triangulation.

In the qualitative research approach for the investigation, Section 508 compliance within a federal supplier was analyzed in depth for four months. Additionally, the possible effects of the training on the engineering design, the organization both financial and cultural, and the individual regarding accessibility education were analyzed. Government actions at the federal or national level commonly have served as frequent subjects of case studies (Yin, 2004).

The investigation answered the following research questions:

1. What aspects of Section 508 compliance are relevant to engineering design for suppliers of the federal government?
2. How did the Section 508 training improve Section 508 compliance in the engineering design process?
3. What observable modifications to employee behaviors concerning universal design were anticipated following training? What occurred?

4. What results did Section 508 training produce in terms of beneficial design, organizational, informational, and financial concepts or actions such as incorporating standards in contract proposals or improving accessibility awareness within the organization?

Section 508 CBT Courses

The Section508.gov website was the prime location for the GSA's Section 508 training. The training courses available on the website were listed as:

1. Designing Accessible Web Sites
2. Accessible Conference
3. Buying Accessible E&IT
4. Section 508 Coordinators
5. Additional Accessibility & Usability Concerns
6. Accessible Video and Multimedia
7. Building and Buying Accessible Software
8. Buying Accessible Computers
9. Opening Closed Products
10. Micro-purchases and Section 508
11. Buying Accessible Telecommunications Products

“Buying Accessible E&IT” took 1.25 hours to complete and “Buying Accessible Computers” took 1.5 hours. These courses covered information regarding Subpart A and 1194.26 of Subpart B. They were designed for those contracting officers and managerial personnel who were tasked with developing requirements for the purchase or

development of an E&IT product or service. “Building and Buying Accessible Software” took 2 hours to complete and “Accessible Video and Multimedia” took 2.5 hours. They covered information regarding 1194.21 and 1194.24 of Subpart B and 1194.41 of Subpart D and were designed for those engineers who are tasked with creating software and documenting procedures for an E&IT product or service. The course for 1194.22 of Subpart B, “Designing Accessible Web Sites,” took 4 hours to complete. It was designed for those engineers who were tasked with developing websites or web technology for an E&IT product or service (<http://section508.gov/index.cfm?FuseAction=Content&ID=5>).

The course for 1194.23 and 1194.25 of Subpart B and 1194.31 of Subpart C, “Buying Accessible Telecommunications Products,” took 1 hour and 50 minutes to complete and “Opening Closed Products” took 1.5 hours. They were designed for engineers and personnel who were tasked with supporting, evaluating, or procuring equipment for an E&IT product or service (<http://section508.gov/index.cfm?FuseAction=Content&ID=5>). Throughout each course, several multiple-choice questions were used to enforce concepts as well as determine the participant’s mastery of the subject material.

At the conclusion of each course, the participant received a certificate of completion electronically. These courses were selected as training instruments as they addressed the individual provisions of each section of the standards. Those courses not defined were not selected as they did not specifically discuss the provisions but rather provided additional information about accessibility. Appendix A presents several screen captures from each course described which serve as a visual representation of the course.

Participant Consent Letter

The participant consent letter included the purpose of the research and its relevance to the organization (see Appendix B). Additionally, the letter contained information regarding the support of the organization's management. Participants were more likely to participate fully and honestly if presented with managerial support. A detailed schedule of involvement was provided, as was an explanation that participation was optional and may withdraw at any time. The letter concluded with a request to respond and further instructions were sent.

Participant Instructions

The population size within the GDAIS facility was 800 employees, which contained subgroups according to the employee's responsibilities. The four subgroups were engineering managers, software designers, web technology designers and procurement, quality assurance, and hardware engineers. There were instructions created for each subgroup (see Appendix C). The instructions detailed the steps to be accomplished and included how to register on the Section508.gov website, what courses each participant needed to complete, how to verify completion of each course, and the website links to the survey and test instruments. They were written in a format that was familiar to employees within the organization including detailed steps, hyperlinks, and screen captures. Three engineering colleagues with over 15 years combined at the facility were asked to review and test the procedures for accuracy, simplicity, and completeness. The feedback was positive and only minor grammar changes were made to the instructions.

Instrument Development

Participant Survey Instrument

Surveys were created for each of the four subgroups of participants (see Appendix D). The locally developed course survey were adapted from a form described by D. L. Kirkpatrick (2007) with the advice that the sample can be adapted for one's own programs. The survey was created using the exact questions from the form with an added course objective section. The guidelines, as described by Kirkpatrick were:

1. Determine what needs to be found out
2. Design a survey that will quantify reactions
3. Encourage written comments and suggestions
4. Elicit honest responses.

The guideline for determining what needs to be found out included questions to quantify reaction to the training content and design. Also, included were questions regarding any new learning, behaviors, or future expectations as a result of the training. The responses were quantified by using a five-point scale.

The questions of the survey were broken down into five sections. First, the training design section asked questions specific to the perceptions concerning the design of the program. Second, the course objectives section asked questions specific to the content of the courses taken. The course objective section was the only section with questions for each subgroup of participants that differed from Kirkpatrick. At the beginning of each course, the objectives were presented. The questions presented these objectives again and asked if the courses have met them. Third, the section "other aspects of the training" asked questions specific to the training material used within the courses

such as the real-life stories. Fourth, the overall rating section measured feelings about the program. Fifth, the training applications measured how the training related to the work responsibilities. The survey concluded with space for additional comments.

The data collected from the survey questions provided a better understanding of how the training improved compliance within the engineering design process. The data collected specifically from the course objectives and other aspects of the training sections provided support to any behavior changes following the training. These data supported any modifications to employee behavior observed during the interview. Additionally, the training application and comments sections provided supporting data to future data collection methods regarding any design, organizational, or financial actions because of the training. In Table 2, the survey question sections were correlated to D. L. Kirkpatrick's survey guidelines and the research questions.

Table 2. Survey Correlation to Kirkpatrick Guidelines and Research Questions

Sections of the Survey Questions	D. L. Kirkpatrick's Level 1 Survey Guidelines	Research Question Application
Training Design	Determining what needs to be found out and designing a survey that will quantify reactions	<ul style="list-style-type: none"> • How did the Section 508 training improve Section 508 compliance in the engineering design process (RQ2)?
Course Objectives	Determining what needs to be found out and designing a survey that will quantify reactions	<ul style="list-style-type: none"> • RQ2 • What observable modifications to employee behaviors concerning universal design were anticipated following training? What occurred (RQ3)?
Other Aspects of the Training	Determining what needs to be found out and designing a survey that will quantify reactions	<ul style="list-style-type: none"> • RQ2 • RQ3
Overall Rating	Determining what needs to be found out and designing a survey that will quantify reactions	<ul style="list-style-type: none"> • RQ2
Training Applications	Determining what needs to be found out and designing a survey that will quantify reactions	<ul style="list-style-type: none"> • What results did Section 508 training produce in terms of beneficial design, organizational, informational, and financial concepts or actions such as incorporating standards in contract proposals or improving accessibility awareness within the organization (RQ4)?
Comments	Encouraging written comments and suggestions	<ul style="list-style-type: none"> • RQ2 • RQ3 • RQ4

Participant Test Instrument

Course specific tests were created for each of the four subgroups of participants since the courses they took differed (see Appendix E). Within each course on the Section508.gov website, there were multiple-choice questions that reinforced previous training material. The locally created tests consisted of the same questions directly taken from the courses as well as original ones. The original questions were statements located in the training material converted into the form of a question. These reinforced the training material necessary for accomplishing the objectives. Additionally, these questions were designed to represent how the training might be applied to an actual job situation as recommended by D. L. Kirkpatrick (2007). Each was applicable to the job responsibility of the participant and met the objectives of the courses. Table 3 lists the association between the test questions asked and the course objectives they met according to the participant subgroup.

Table 3. Test Questions Association With Course Objectives According to Participant Subgroup

Participant Subgroup	Test Question	Course Objective the Test Question Meets
Engineering Manager	Section 508 applies to all organizations solicited by federal agencies when they develop, procure, maintain, or use electronic and information technology.	Explain the requirements of the standards for Section 508 as they pertain to electronic and information technology.
	Non-compliance of Section 508 standards can result in:	Explain the implications for failure to comply with 508.
	The term “undue burden” allows exceptions to meeting Section 508 but it requires:	Define undue burden, commercial non-availability, and equivalent facilitation.
	What are requiring officials responsible for?	Describe the responsibilities of the requiring official.
	New computers are being purchased for the software engineering group. What Section 508 requirements cover control during normal operation of the system?	Understand how the requirements for mechanically-controlled products apply to controls for computers
	What resources are available to assist in the procurement of computers and equipment?	Identify resources to assist in the procurement of accessible desktop and portable computers.
	What is a VPAT?	Identify resources to assist in the procurement of accessible desktop and portable computers.
Software Designer	Usability and accessibility refer to the same thing.	Differentiate between usability and accessibility.
	The way(s) to provide information about a graphical user interface is:	Describe how textual information can be conveyed through the system.
	To ensure an application is accessible using only the keyboard, you should:	Ensure software can be completely operational using only a keyboard
	Section 508 applies to all organizations solicited by federal agencies when they develop, procure, maintain, or use electronic and information technology	Explain the requirements of the standards for Section 508 as they pertain to electronic and information technology.
	A training video for the new accounting information system created for an agency does not require captions and audio description.	Determine what parts of a video or multimedia product need to include audio descriptions.

Participant Subgroup	Test Question	Course Objective the Test Question Meets
	Besides aiding those with hearing loss, captions also:	List questions to ask vendors concerning video and multimedia accessibility capabilities.
	Which of the following are functions of Assistive Technology?	Compare and contrast general approaches to software accessibility.
Web Technology Engineer	A way to avoid causing the screen to flicker is to avoid using any blinking or flashing text or animation.	Use non-text elements that comply with the Section 508 standards.
	A form on a website is accessible if the user can:	Design an accessible Web-based form.
	All data tables on a website should have headers for the row and column.	Design accessible HTML tables for data and layout.
	The standards requires that color on a website be used only as:	Use color in compliance with Section 508.
	Section 508 applies to all organizations solicited by federal agencies when they develop, procure, maintain, or use electronic and information technology.	Explain the requirements of the standards for Section 508 as they pertain to electronic and information technology.
	What steps should you take to ensure accessibility when offering a PDF document on a web page?	Understand the accessibility limitations to using Adobe PDF files.
	What must you do to create applets that meet the section 508 guidelines?	Understand the basics of Java's accessibility features
Procurement, Quality Assurance, Hardware Engineer	Which of the following are requirements for telecommunications products in order to conform to Section 508?	Describe accessibility requirements for telecommunications products with mechanically operated controls or keys.
	A typical "self contained, closed" product would:	Explain what is and what is not covered under the provisions for self contained, closed products.
	The telecommunications provision of the Section 508 standards addresses which types of access:	Identify the standards that apply to devices with manually operated controls or keys and how these provisions affect the product.
	A "self-contained, closed" product	Determine to what degree a

Participant Subgroup	Test Question	Course Objective the Test Question Meets
	must have a time-out period preceded by a warning and an option to request more time.	product conforms to the 508 requirements for self contained, closed products.
	What is a VPAT?	Identify resources to assist in the procurement of accessible telecommunications products.
	Telecommunication products or systems that provide voice communications do not have to provide TTY functionality.	Understand how to check for conformance with the technical standards.
	Section 508 applies to all organizations solicited by federal agencies when they develop, procure, maintain, or use electronic and information technology	Explain the requirements of the standards for Section 508 as they pertain to electronic and information technology.

Participant Interview Instrument

The interview instrument consisted of questions created to obtain data regarding observable modifications to employee behaviors concerning universal design following training. Appendix F lists the locally developed interview questions adapted from a pattern interview described by D. L. Kirkpatrick (2007) which he considered the best approach in getting behavior modification information. D. L. Kirkpatrick added that the questions of his patterned interview can be used as is or adapted for one's own particular situation and that interview questions should deal with how the participants applied what they have learned towards their job. For proper behavior evaluation of trainees, they were allowed between two or three months to transfer the training to the job.

Following was the list of interview questions:

1. What other Section 508 or accessibility training or information have you received since the online courses?
2. Describe how Section 508 compliance is relevant here at work.

3. What do you think is a good approach for teaching the Section 508 standards?
4. What specific design knowledge or skills did you gain from the training?
5. Describe how eager you were to change your behavior on the job after the training.
6. Provide an example of any application of the Section 508 standards to your work.
7. List any reasons why you are not currently applying any of the standards.
8. Discuss how your awareness of accessibility issues has changed at work or outside of work.

The first question highlighted if any of the participants received or experienced any Section 508 training outside the training courses, which is a defined limitation. The question tried to highlight if the limitation may affect the results of the research. The second question focused on understanding if the participants found any relevance to the engineering design within organization regarding compliance, which provided supporting data for the aspects of Section 508 compliance relevant to engineering design for federal government suppliers. The third interview question asked if the training reinforced the Section 508 standards, which provided supporting data for how the training improved Section 508 compliance in the engineering design process.

The fourth, fifth, and sixth questions supported collecting data for observable modifications to employee behaviors concerning universal design following the training. These questions focused on knowledge gained from the training and its application by the participants to their job. Additionally, the seventh question attempted to understand the reasons for the participants not applying the new training skills, which supported possible concepts or recommendations resulting from training that GDAIS should apply. The final

question supported the fourth research question regarding any design, organizational, information, and financial actions or concepts as the result of the training. The interview process included following the given line of questioning but also conversing with the participant about the subject matter. Yin (2003) wrote that case study interviews are open-ended where the participants provided insight into a matter through nonthreatening questions.

Validity and Reliability

Validity is defined as whether the instruments measure what they are intended to measure (Gay & Airasian, 2003; Leedy & Ormrod, 2005). Leedy and Ormrod recommended seeking the opinions of experts in the field of study as a strategy for validation. A group of individuals were asked to participate as a panel of experts according to certain important criteria. In Table 4, the expert panel is listed along with their title and areas of expertise.

Table 4. Expert Panel

Expert Name	Title	Expertise
Mr. David Baquis	Accessibility Specialist U.S. Access Board	<ul style="list-style-type: none"> • Accessibility specialist • Section 508 compliance educator
Mr. Shaun Galliher	Senior Lead Government Contract Specialist GDAIS	<ul style="list-style-type: none"> • Over 25 years government contract experience • Government standards compliance experience • Survey and training material experience • Interviewing experience
Mr. Ronald Mauk	Technical Manager Software Engineering GDAIS	<ul style="list-style-type: none"> • Over 20 years software engineering experience • Interviewing experience • Government standards compliance experience
Mr. Christopher Morin	Principal Software and Web Technology Engineer GDAIS	<ul style="list-style-type: none"> • Over 20 years engineering experience • CBT development experience
Mrs. Tracey Richards	Lead Specialist in Environmental, Health, and Safety GDAIS	<ul style="list-style-type: none"> • Three years environmental, health, and safety experience • CBT development experience • Interviewing experience • Government standards compliance experience
Mrs. Pam Weisberg	Training Operations Manager GDAIS	<ul style="list-style-type: none"> • Thirteen years training development experience • Interviewing experience • Government standards compliance experience

The criteria for being a member of the expert panel included familiarity with the population at GDAIS as an engineer or job directly related to interacting with engineers. Experiences as a trainer, developing training, or as an interviewer for GDAIS were other criteria. It was imperative that several panel members be aware of compliance to

government legislation as it relates to GDAIS. Additionally, a panel member who had direct knowledge of the USAB and the Section 508 standards was important. The individuals were in a position where they could attest to the accuracy, completeness, and consistency of coverage of survey, test, and interview questions. Each expert panel member was visited and asked to join the panel. Following a brief summary of the research and their role as an expert, each member was given a package containing a copy of each instrument. They were asked to review all the questions individually and provide feedback for each question and form according to certain guidelines. The only exception to this process was the expert panel member from the USAB. All communication to this expert was conducted through the telephone and the review package sent through electronic mail.

These guidelines closely followed those recommended by Gay and Airasian (2003) when designing a questionnaire and interview questions. The members were asked to evaluate if the questions were presented in a logical and organized manner. Additionally, the members were to evaluate if the questions were clear, simple and presented only one idea. Finally, the members were asked for improvements to the forms including additions or removals of questions. As a result of the expert panel, minor corrections were made to the instruments including editing grammar mistakes and adding missed punctuation. Additionally, words such as “the best” or “the easiest” were removed from two test questions as they could result in confusion. The expert panel reviewed and validated the instruments to obtain valid and reliable results.

Reliability is defined as whether the instruments produce consistent results on two different occasions (Gay & Airasian, 2003; Leedy & Ormrod, 2005). Pilot-testing the

instruments to ensure they yield reasonable unbiased data was recommended. All instruments were pilot-tested using four employees at GDAIS who were excluded from participating in the formal data collection. These individuals were given paper versions of the instruments and asked to complete them and provide feedback. Following two weeks, each test was administered to the pilot-test participants. The pilot-test ensured that each survey, test, and interview question was clear, understandable, interpreted correctly, and produced consistent results.

Yin (2003) wrote that reliability is increased through providing and following a case study protocol. A case study protocol should contain certain important sections. One section should provide an overview of the project through relevant literature about the topic. A second section should provide study questions along with the method of collecting data to answer them. A third section should provide an outline for the report, which will simplify the collection of data, the format of the results, and itemize all cited documents. The document for the current study provided and followed a firm but flexible protocol similar to the previously mentioned sections. Yin stated that maintaining a chain of evidence is a principle to follow to increase the reliability of information within a study. The evidence referred to the information and data gathered in support of the objectives of the study. The principle provided an external observer with the process of data collection from the initial research questions to the conclusions. Yin concluded that by satisfying the objectives of the study through the principle of maintaining the chain of evidence, construct validity is determined.

Approach

Participant Selection

Within a typical engineering group at GDAIS, there were a manager, a procurement engineer, an administrative assistant, two quality assurance engineers, five hardware engineers, five web technology engineers, and 15 software designers. Leedy and Ormrod (2005) wrote that the response rate or percentage of people agreeing to participate is 50% or less in mailed survey research. Establishing rapport and trust through face-to-face meetings with potential participants was recommended to gain cooperation, honest responses, and obtain a high response rate (Gay & Airasian, 2003; Leedy & Ormrod). To obtain a sample size consisting of 30 to 40 individuals, 60 individuals were asked to participate following a face-to-face meeting and discussion.

The sample consisted of approximately a manager, 15 software designers, five web technology designers, and 10 procurement, quality assurance, and hardware engineers. The size reflected proportions of each subgroup, which provided conclusions about the entire population as defined by Leedy and Ormrod (2005). The reason for selecting the small sample size of participants compared to the total population was to obtain rich information that yielded specific information on the subject matter rather than superficial information. The number of sampled subjects of 30 to 40 conformed to recommendations by Gay and Airasian (2003), Leedy and Ormrod (2005) and similar studies by Haupt and Blignaut (2007), and Robinson (2008).

Participant Selection Process

Between March 23 and March 30, 2009, after IRB and committee approval, face-to-face meetings were conducted with 72 potential participants:

- 9 engineering managers
- 27 software designers
- 11 web technology engineers
- 25 procurement, quality assurance, and hardware engineers

Following the advice of Gay and Airasian (2003) and Leedy and Ormrod (2005), rapport and trust were established through face-to-face meetings with potential participants to gain cooperation, honest responses, and obtain a high response rate. The face-to-face meetings began with a review of the participant consent letter (see Appendix B). A short discussion followed regarding the purpose of the research, its relevance to the organization with support by management, and the activities that would be required. The potential participants were given copies of the consent letter to read and were told they would be visited the following day regarding their decision to participate.

The following day, each potential participant was revisited to obtain his permission and witness the signing of the consent letter. All but 11 of the original group agreed to take part in the investigation. Of the remaining 61 were:

- 8 engineering managers
- 20 software designers
- 11 web technology engineers
- 22 procurement, quality assurance, and hardware engineers

Responses from individuals who decided not to participate included: no available time to complete the task, vacation planned during time requested, no interest in the material, and no interest in supporting GDAIS approved research without a contract number to charge the company for their time. Upon the participant's receiving a copy of their signed and witnessed consent letter, each was sent an email with instructions unique unto his group (see Appendix C).

Research Question One: Relevant Aspects of Section 508

The first issue addressed understanding the aspects of Section 508 compliance relevant to organizations that supply products to the federal government through data collection from the current literature. Leedy and Ormrod (2005) and Yin (2004) agreed that for the purpose of a case study, obtaining appropriate written documents such as journal articles was a valid data collection method. Current literature was discussed that focused on the role between Section 508 compliance and federal suppliers. Yin (2003) added that the most important use of documents is to support the evidence from other data collection sources used. The steps to find solutions to the second, third, and fourth research questions followed the completion and evaluation of Section 508 training by a selected sample size from the population.

Research Question Two: Training and Compliance

A population of 60 received a participant consent letter following a face-to-face meeting and discussion. The large population pool provided a greater chance that a sample of 30 to 40 potential participants agreed to participate. Additionally, Gay and

Airasian (2003) recommended contacting nonrespondents if more than 20% do not respond. Potential participants that did not respond within a few days of the initial face-to-face meeting received the participant consent letter once again following a second face-to-face meeting. Upon obtaining written permission, the recipient received instructions that vary depending on his job. After registration at the Section508.gov website, he was instructed to take the courses that match his job responsibilities. Engineering managers took “Buying Accessible E&IT” and “Buying Accessible Computers.” Software designers took “Building and Buying Accessible Software” and “Accessible Video and Multimedia.” Web technology designers took “Designing Accessible Web Sites.” Procurement, quality assurance, and hardware employees took “Buying Accessible Telecommunications Products” and “Opening Closed Products.” In Table 5, each CBT course is listed along with the corresponding Section 508 standard and the participant subgroup who took the course.

Table 5. Information Regarding Training Courses

Section Number Training Satisfies	Training Participant Subgroup	Section508.gov CBT course
1194.1	Engineering Manager	Buying Accessible E&IT
1194.2	Engineering Manager	Buying Accessible E&IT
1194.3	Engineering Manager	Buying Accessible E&IT
1194.4	Engineering Manager	Buying Accessible E&IT
1194.5	Engineering Manager	Buying Accessible E&IT
1194.21	Software Designer	Building and Buying Accessible Software
1194.22	Web Technology Engineer	Designing Accessible Websites
1194.23	Procurement, Quality Assurance, Hardware Engineer	Buying Accessible Telecommunications Products
1194.24	Software Designer	Accessible Video and Multimedia
1194.25	Procurement, Quality Assurance, Hardware Engineer	Opening Closed Products
1194.26	Engineering Manager	Buying Accessible Computers
1194.31	Procurement, Quality	Opening Closed Products

	Assurance, Hardware Engineer	
1194.41	Software Designer	Building and Buying Accessible Software

Following the completion of training, each participant completed a locally developed course evaluation and a locally developed course specific test to satisfy Level 1 and Level 2 of the Kirkpatrick model (Weinstein, 2007). The Level 1 evaluation consisted of immediate employee feedback to questions regarding their reaction to the courses. The locally developed set of questions commonly known as a smile sheet focused on employee reaction to the usefulness of the training material, and any feedback regarding the value to applying the material to work responsibilities (Bregman & Jacobson, 2000; Haupt & Blignaut, 2007; Weinstein). The survey included questions regarding knowledge gained by participants, new behaviors learned from the training and results that helped reinforce data received during collection in subsequent levels (Kirkpatrick, D. L., 2007).

The Level 2 test consisted of a series of multiple-choice questions, which validated learning and improved skills for compliance purposes (Kirkpatrick, J., 2007). The employee feedback and test results served as a method to understand how the training improved compliance in the design process. From the data collected, Section 508 compliance was assessed. Additionally, any effects of the training such as increased knowledge or awareness of accessibility or improved attitude towards the training on the participants were interpreted from the data as supported by Haupt and Blignaut (2007) and J. Kirkpatrick (2007).

Research Question Three: Behavior Modifications

Approximately two months following completion of the given courses, interviews were conducted of the same sample of 30 to 40 participants who previously completed a course evaluation and a course specific test. The interview focused on studying and understanding the behavioral changes of the participants, which is a common tool, used at Level 3 (Kirkpatrick, J., 2007; Weinstein, 2007). Additionally, the interview provided information regarding performing the behavior for a sustained period which Haupt and Blignaut (2007) considered an important criteria for satisfying Level 3 data collection. Yin (2004) added that interviews are a common form of data collection within a study. It was essential that the interview questions highlighted any change of belief and perspective made to employee behavior regarding the principles of universal design at the workplace.

Research Question Four: Training Benefits

Additional interpretation of the data received from previous levels was necessary to determine what beneficial design, organizational, informational, and financial concepts or actions resulted from the training regarding accessibility. The data from the three levels were interpreted following any patterns, themes, or changes over time to produce Level 4 results. Spitzer (1999) added that for Level 4 results use the same steps for Level 3 but target organizational measures. The focus included accessibility improvements to design or products, which provided advantages to the customer as well as enhanced business measures for GDAIS. These advantages included increasing contract proposal participation due to the added Section 508 training. Additionally, the data was interpreted

to understand any reduction or removal of barriers to accessibility for employees, customer, or the organization. Leedy and Ormrod (2005) added that the analysis in a study should focus on specific meanings gained from the data collected.

Participant Treatment

The treatment ran from March 30 through April 14, 2009. It consisted of independent completion of the online training material created and hosted on the Section508.gov website (see Appendix A) (<http://section508.gov/index.cfm?FuseAction=Content&ID=5>).

The eight engineering managers were provided information to assist them in applying Section 508 standards to their job responsibilities through improving their accessibility knowledge, and developing their managerial skills regarding decision making for accessibility. They were asked to complete the “Buying Accessible E&IT” and “Buying Accessible Computers” courses listed on the Section508.gov website. The first took an estimated 75 minutes to study 75 slides and the second, an estimated 105 minutes to study 72 slides.

The 20 software engineers were provided training material to assist them in applying the standards towards the design, creation, and documentation of software for an E&IT product or service. They were asked to complete the “Building and Buying Accessible Software” and “Accessible Video and Multimedia” courses listed on the Section508.gov website. The first took an estimated 130 minutes to study 119 slides and the second, an estimated 120 minutes to study 110 slides.

The 11 web technology engineers were provided training material to assist them in applying the standards towards developing and maintaining websites or web technology for an E&IT product or service. They were asked to complete the “Designing Accessible Web Sites” course listed on the Section508.gov website. It took an estimated 240 minutes to study 201 slides.

The 22 procurement, quality assurance, and hardware engineers were provided training material to assist them in applying the standards towards supporting, evaluating, or procuring equipment for an E&IT product or service. They were asked to complete the “Buying Accessible Telecommunications Products” and “Opening Closed Products” courses. The first took an estimated 110 minutes to study 56 slides and the second, an estimated 120 minutes to study 98 slides.

Table 6 lists the CBT courses from the Section 508.gov website with corresponding sections and the participant subgroup who took the course.

Table 6. List of Section508.gov Courses Taken by Participants

Course Title	Course Section Titles	Participant Subgroup
Buying Accessible E&IT	It's the Law, Disabilities and Accessibility, and 508 and the Procurement	Engineering Manager
Buying Accessible Computers	It's the Law, Disabilities and Accessibility, Introduction to Desktop and Portable Computers, Mechanically-operated, Touch, and Biometric Controls, Connectors, and Applying the Standards to Computer Procurements	Engineering Manager
Building and Buying Accessible Software	It's the Law, Disabilities and Accessibility, Introduction to Accessible Software, User Interaction, Compatibility with Accessibility Features and Settings, Using Graphical and Textual Elements, and Examining Software for Conformance with Section 508	Software Engineer
Accessible Video and Multimedia	It's the Law, Disabilities and Accessibility, Video and Multimedia Accessibility Standards, Captioning Pre-recorded and Live Video and Multimedia, and Audio Describing Video and Multimedia	Software Engineer
Designing Accessible Web Sites	It's the Law, Disabilities and Accessibility, Designing to the Standards, Frames and Style Sheets, Alternatives for Multimedia, Scripts and Applets, On-line Forms and Adobe PDF files, and Validation	Web Technology Engineers
Buying Accessible Telecommunications Products	Introduction to Telecommunications, Telecommunications Product Accessibility for TTY users, Telecommunications Product Accessibility for people with Hearing Loss, Requirements for Caller ID and Response Time, Mechanically Operated Controls and Keys, and Applying the Standard to Telecommunications Product Procurements	Procurement, Quality Assurance, and Hardware Engineer
Opening Closed Products	It's the Law, Disabilities and Accessibility, Introduction to Self contained, Closed Products and Accessibility, Physical Features of Closed Products, Interacting with Closed Products, Outputs from Closed Products, and Purchasing Self contained, Closed Products	Procurement, Quality Assurance, and Hardware Engineer

Upon completion of the training course materials, each subject took an attitude survey and course-specific test followed two months later by interviews. Each survey consisted of either 15 or 16 questions taking approximately 20 minutes. The questions

were broken into six sections whose questions were correlated to D. L. Kirkpatrick's guidelines and the research questions as described in Chapter 3. Each test specific to a subgroup consisted of seven multiple-choice questions taking approximately 15 minutes. On May 6, 2009, survey and test results were exported from zoomerang.com to Microsoft Excel files. Each interview took approximately 20 to 30 minutes to complete and consisted of several questions asked of the participant with the researcher recording his answers directly on a printout of the questions. All data collected from the survey, test, and interviews were anonymously distinguished by subgroup with no names attached.

Resources

After discussion with members of GDAIS management in Pittsfield, Massachusetts, their full support was provided. The entire population of approximately 800 employees was made available to participate. The organization provided their employees with semi-private cubical offices and technology that enabled them to conduct the training on their own time. A workstation computer with monitor, keyboard, mouse, and Windows XP as the operating system was provided for each employee. Each employee was provided an electronic mail account created through the organization's mail server, Microsoft Exchange 2003 and accessed through the exchange application on his workstations. Communication to participants was conducted through the electronic mail system. The employee participants consisted of approximately a manager, 15 software designers, five web technology designers, and 10 procurement, quality assurance, and hardware engineers.

Each workstation had Internet Explorer 7, a web browser application, and provided the participants with free Internet access to conduct the training. The material of the Section 508 courses was provided through the Section508.gov website. Following training, each participant through his web browser accessed a given Internet address, completed a given survey, and test. The surveys and tests were created through using the free survey tool available over the Internet at zoomerang.com. The organization had over 30 conference rooms available that were made available through an administrative assistant to conduct private interviews of the participants. No special requirements or resources were needed.

The following was a proposed timeline for completion of the process:

1. Obtain written permission for participation from potential participants at GDAIS (April 6, 2009).
2. The participants conclude taking courses, surveys, and tests (April 20, 2009).
3. Conduct interviews on individuals who participated in the Section 508 training (June 15, 2009).
4. Observe patterns, themes, or behavioral changes from the interviews of the Section 508 participants (June 22, 2009).
5. Analyze results of the collected data and observations regarding the Section 508 training (July 6, 2009).
6. Obtain committee approval of the dissertation report (September 30, 2009).

Summary

In conclusion, the purpose of a case study was providing an audience with a rendition of reality through the building of an argument (Yin, 2006). The argument regarding Section 508 and the effects of adhering to the standards on engineering design, which foster universal design skills and increase accessibility awareness within a federal supplier were created by following a chronological sequence as supported by Yin. The chronological sequence was created through the process of collection, analysis, and presentation of data at given periods. The process was repeated for as many times as necessary. The results of each process were interwoven together through themes developed from the research questions. The investigation supported the iterative process as described by Yin.

Chapter 4

Results

The problem addressed was the deficiency of incorporating the standards of Section 508 into the design process at GDAIS. The goal was to introduce and use a government-created, computer-based training program for design engineers and managers to cultivate universal design skills, increase accessibility awareness, and educate regarding the standards of Section 508. As presented in Chapter 3, the approach taken was a case study within a real life context in which data were collected through various sources such as documents, surveys, tests, and interviews.

CBT training was designed to focus on aspects of the standards that applied to the different work groups at GDAIS. Content of the training was provided on a government website. A test of knowledge learned and a survey to reflect attitudes toward accessibility in product design were written and tested for validity and reliability. Volunteer participants were recruited. Those selected took part in approximately four hours of training over a two-week period, took the test and completed the survey. Approximately two months after training, interviews with the participants were conducted to explore behavioral and attitude changes regarding Section 508 and accessibility. Possible effects of the training on the engineering design, the organization both financial and cultural, and the individual regarding accessibility education were examined. Findings are presented in a descriptive narrative form with supporting data in table format.

Attitude Survey Findings

The participants evaluated the training courses regarding their design, the material satisfying the course objectives, aspects of the training, and the application of the training to the participant's job responsibilities and organization. Participants that completed the survey included:

- 4 engineering managers
- 12 software designers
- 7 web technology engineers
- 14 procurement, quality assurance, and hardware engineers

A majority (88% of managers, 78% of software designers, 72% of web technology engineers, and 100% of procurement, quality assurance, and hardware engineers) reported that they now understand how the standards apply to their job responsibilities. Additionally, most felt the training goals were clearly communicated, and the training material was well organized, easy to understand, and the appropriate difficulty level and length.

Participants are more likely to complete the training if they have a positive attitude towards the material according to D. L. Kirkpatrick (2007). Of the three comments offered by engineering managers, two noted the unnecessary repetition of the first two sections in each module. For example, "there [were] two sections that were common to the two courses [;] it seemed like a waste of time to go through them twice." Similarly, of the seven comments offered by software designers, two noted the same repetition. For example, "pull out the duplicate front matter in each section and have a 508 overview lesson."

A majority of engineering managers (75%), software designers (83%), web technology designers (79%), and procurement, quality assurance, and hardware engineers (79%) felt that the multiple-choice questions and real-life stories found within the training material reinforced ideas and enhanced learning. There was a high level of agreement that online training was an effective learning environment and the training itself was worth taking. Of the 21 comments, four noted similar positive responses regarding the training. For example, “the training was excellent,” and “the training was well presented.” One engineering manager commented that grammar mistakes and the real-life situations distracted from the subject while another felt that more multiple-choice questions during training would be helpful. One web technology engineer noted a recommendation for more multiple-choice questions within the training material.

The majority of engineering managers (75%) and web technology engineers (71%) indicated an intention to apply what they learned to their jobs to improve product design or improve the design process. Software designers differed on the feasibility of applying what they learned to product design with one comment stating that it “might be hard to apply to my current job.” A reason for the differences could be that the topics covered in the training are based on older technology since the standards were developed with technology from the year 2001. Procurement, quality assurance, and hardware engineers indicated that they were not positive on applying what they learned in the training to their job. There are individuals within this group whose responsibilities are support and testing. One comment from this group stated that the “training is good, but does not apply to our work environment.” While these individuals might not specifically

design products, their job responsibilities must ensure that all software and hardware that make up a product are open and accessible.

A majority of engineering managers (100%), software designers (58%), and web technology engineers (57%) recommended the training for others in the organization. It is important to note that a small percentage (14%) of web technology engineers surveyed would not recommend the training to others in the organization. An explanation was that the training material is outmoded and supported by one web technology engineer who commented that “the content is ten years out of date.” Procurement, quality assurance, and hardware engineers differed from the other three subgroups. Explanations included course or website technical issues. Of the eight comments offered by procurement, quality assurance, and hardware engineers, three noted these difficulties. For example, “web site was a little hard to follow, had to log in four times,” and “I could not get videos to run and some of the demos.”

There were differences in the belief that the material learned from the training would improve the design of GDAIS products. A majority of software designers (67%) and web technology engineers (58%) agreed or slightly agreed that the standards would improve the design of GDAIS products. One software engineer disagreed by commenting that they found “it difficult to see how Section 508 standards would impact the products that GDAIS provides the US Navy, as this falls under the category National Security exemption.” Engineer managers and procurement, quality assurance, and hardware engineers differed in opinion.

Similarly, there were differences in the belief that the organization would benefit from following the standards. A majority of software designers (59%) and web

technology engineers (71%) agreed or slightly agreed that the standards would benefit the organization. Engineer managers and procurement, quality assurance, and hardware engineers had different opinions. Section 508 education and procedural improvement information gained from other organizations that used the standards will improve these scores.

In conclusion, a majority (92%) agreed or slightly agreed that the training made them more aware of accessibility issues and the standards. One commented that the “training was very effective in making you realize how much you take for granted; as things get smaller and smaller with more capabilities the Section 508 requirements will be even more appropriate, even to those without disabilities.” Appendix I shows all of the survey data collected from engineering managers, software designers, web technology engineers, procurement, quality assurance, and hardware engineers. Questions that did not match amongst the subgroup surveys received an “N/A” or “not applicable” rating.

Test Findings

Tests were written to reinforce the training course objects and evaluate knowledge learned. Participants that completed the tests included:

- 4 engineering managers
- 12 software designers
- 7 web technology engineers
- 12 procurement, quality assurance, and hardware engineers

Engineering managers received training to apply the standards to their job responsibilities that included applying the technical requirements to computer systems

and procurements. These goals were reinforced by the test questions, which additionally measured learned knowledge. First, all of the managers tested learned that the standards apply to organizations solicited by federal agencies and the responsibilities of a requiring official, which directly relates to GDAIS. These skills include developing requirements, conducting market research, and documenting all exceptions to meeting Section 508 compliance for products and services solicited by the federal government.

Second, all the managers understood the general exception of undue burden and the resources available by the government to assist them in procuring E&IT products and services such as the GSA accessibility online tool. Equally important was that engineering managers understood the significance of a VPAT. A VPAT is a document that provides a description of how solicited products and services meet accessibility standards and is a valuable resource provided by organizations. Third, engineering managers understood compliance relating to the purchase of computers, which is a common managerial task at GDAIS. In conclusion, engineering managers learned the implications for a product or service failing to comply, which should provide additional motivation to implement the standards. See Table 7 for the test results.

Table 7. Engineering Manager Test Results

Test Question	Percentage Correct
Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.	100%
Non-compliance of Section 508 standards can result in:	75%
The term “undue burden” allows exceptions to meeting Section 508 but it requires:	100%
What are Requiring Officials responsible for?	100%
New computers are being purchased for the software engineering group. What Section 508 requirements cover control during normal operation of the system?	75%
What resources are available to assist in the procurement of computers and equipment:	100%
What is a VPAT?	75%

Software designers received training to understand how to apply the standards to their job responsibilities that included applying design techniques for ensuring software and multimedia accessibility. The test questions reinforced and evaluated the knowledge learned. First, software designers learned that all the standards apply to organizations solicited by federal agencies, which directly relates to GDAIS. Second, all understood the differences between usability and accessibility when designing software. Usability enables the software to perform functions required while accessibility allows software to be used by individuals regardless of capabilities. Third, software designers learned providing accessibility to a graphical user interface (GUI) by applying the standards through the use of color and text, which typically are found within products of GDAIS.

In addition, software designers understood that captioning is essential within any imbedded video in a software product especially training material. A small percentage (8%) did not fully understand the value of captions, which could be attributed to individuals who do not use captions, or have never experienced their use as an aid in learning a second language, or in understanding content in noisy environments. In conclusion, software designers learned how disabled users use software products and services through Assistive Technology for input and output. Ensuring these characteristics will enable users of various skills and abilities to use software products and services developed for the federal government. See Table 8 for the test results.

Table 8. Software Engineer Test Results

Test Question	Percentage Correct
Usability and accessibility refer to the same thing.	100%
The way(s) to provide information about a graphical user interface element is (are):	92%
To ensure an application is accessible using only the keyboard, you should:	100%
Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.	92%
A training video for the new accounting information system created for an agency does not require captions and audio description.	100%
Besides aiding those with hearing loss, captions also.	92%
Which of the following are characteristics of Assistive Technology?	100%

Web technology engineers received training to understand how to apply the standards to their job responsibilities of making web technology accessible. The test questions reinforced this goal and evaluated the knowledge learned. First, all of the web technology engineers tested learned that the standards apply to organizations solicited by federal agencies, which directly relates to GDAIS. Second, they understood how to create accessible websites by implementing web pages with limited flickering, web forms with accessible fields, and all rows and columns of tables with textual headers. Using color only as a secondary indicator of text meaning is another mechanism to create accessible websites specifically designed for users who have color-blindness. A majority (86%) of web technology engineers tested correctly their understanding of the mechanism. The incorrect answer chosen by one web technology engineer can be interpreted that the individual did not see color on a website as a viable alternative for displaying any information whether primary or secondary but rather text.

Third, all of the web technology engineers understood that applets on a website must be device-input independent so that all users can interact with the script. Nearly every website requires the use of applets to provide functionality to the user such as

running video or music media. In conclusion, a small percentage (43%) of web technology engineers learned that a document in the form of a Portable Document Format (PDF) is made accessible through providing a link to the PDF accessibility converter. PDF files are commonly used within GDAIS websites to provide organizational, project, and training documents. Those web technology engineers who selected creating an alternative HTML file might not have read in the training that a PDF converter exists. The selection of one incorrect answer does display that web technology engineers would rather create additional website accessibility functionality over selecting the other incorrect answer that leaves accessibility to the user through links for downloading the file. See Table 9 for the test results.

Table 9. Web Technology Engineer Test Results

Test Question	Percentage Correct
A way to avoid causing the screen to flicker is to avoid using any blinking or flashing text or animation:	100%
A form on a website is accessible if the user can:	100%
All data tables on a website should have headers for the row and column.	100%
The standards require that color on a website be used only as:	86%
Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.	100%
What steps should you take to ensure accessibility when offering a PDF document on a web page:	43%
What must you do to create applets that meet the section 508 guidelines?	100%

Procurement, quality assurance, and hardware engineers received training to understand how compliance related to self contained, open products and can only be achieved through including the standards in the requirements of a telecommunication product. The test questions reinforced this goal and evaluated the knowledge learned. First, these engineers tested learned that the standards apply to organizations solicited by

federal agencies, which directly relates to GDAIS. Second, they understood the definition of a self contained, closed product that must have an extended time-out period. These products are devices whose software are embedded and cannot be easily opened for modification but must be evaluated or procured to be accessible.

Third, a majority (83%) of procurement, quality assurance, and hardware engineers tested correctly that telecommunication requirements in order to meet compliance must address communication, information, and physical access.

Communication access not only includes screen reader capability but also the support for TTY users. Physical access requires the controls and keys of telecommunication products to be tactilely discernible. In conclusion, procurement, quality assurance, and hardware engineers learned the purpose of a VPAT, which provides engineers who solicit products a description of how vendor products and services meet accessibility standards. These documents should be available by vendors when procurement, quality assurance, and hardware engineers purchase and test products in support of GDAIS projects. See Table 10 for the test results.

Table 10. Procurement, Quality Assurance, and Hardware Engineer Test Results

Test Question	Percentage Correct
Which of the following are requirements for telecommunications products in order to conform to Section 508?	75%
A typical “self contained, closed” product would:	83%
The telecommunications provision of the Section 508 standards addresses which types of access:	83%
A “self-contained, closed” product must have a time-out period preceded by a warning and an option to request more time.	92%
What is a VPAT?	83%
Telecommunication products or systems that provide voice communications do not have to provide support for TTY users?	92%
Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.	75%

Interview Findings

As recommended by D. L. Kirkpatrick (2007), interviews were conducted from June 8 through June 26, 2009, several months after training was completed. The time frame was found to be a valid method of evaluating on the job behavior. Yin (2003) adds that interviews are open-ended where the participants provide insight into a matter through nonthreatening questions. Through a face-to-face meeting, each of the 61 individuals who agreed to take part in the investigation was asked to participate in an interview with 31 being interviewed that included:

- 3 engineering managers
- 11 software designers
- 6 web technology engineers
- 11 procurement, quality assurance, and hardware engineers

The answers provided data regarding observable modifications to employee behavior as result of the training. Responses from the 30 individuals who declined to participate in the interview process included: forgetting to complete the training, taking vacation during time requested, and family emergencies. Upon completion of the interview, each completed printout was grouped according to subgroup for ease of future analysis.

As supported by Roberts (2004), all interview data were read several times and analyzed for significant and meaningful themes and patterns. D. L. Kirkpatrick (2007) states that changes in job behavior are evaluated by understanding the application and transfer of learned knowledge, skills, and attitudes to work responsibilities. The following findings are presented:

Question 1: What other Section 508 or accessibility training or information have you received since the online courses?

All the participants stated that they did not take any additional training outside the courses available on the Section508.gov website. One engineering manager commented that he “took an extra one based on software” listed on the Section508.gov website because he was interested in learning more about the standards especially how they related to other job responsibilities.

Question 2: Describe how Section 508 compliance is relevant here at work.

The majority (71%) of the participants felt the standards were relevant to the organization, which could provide motivation to apply them in support of government E&IT. All the engineering managers stated that the standards were relevant for GDAIS but there were differing reasons. There were two themes reported: supporting disabled employees who work at the facility and usability of the products for end users. Comments included relevance for “workstations modified for physical access, aesthetics, and ergonomics,” “make things easier to use; usability of design,” and “expands available pool of resources and functionality for employees and end users.” The application of Section 508 would make the designed products and tools more usable for the individuals who work on them as well as for the end user. These products included hardware such as “desktop computers,” “information technology,” and “telephone equipment.”

There were other comments regarding business processes. One engineering manager stated that the standards were fiscally relevant for the business in “understanding the analysis of meeting or not meeting regarding government acquisition” since they “show up in proposals.” One software designer felt the standards could be

relevant to “streamline training, installation, and maintenance.” These comments show that individuals understood that the standards apply to not only product design but also benefits individuals and the organization.

Seven individuals responded that the standards were inappropriate for many of the military and national security products produced by the organization. Section 508 provides a mechanism to which an organization does not have to meet the standards through a national security exception. The law states that the exception exempts federal agencies from applying the standards to any E&IT whose use involves intelligence, cryptologic, weapon, or command and control activities (USAB, 2000). The USAB adds that software, web applications, and hardware used for administrative and business applications must comply with the standards even if developed, procured, and maintained for national security purposes. GDAIS provides many products and services for administrative and business purposes in support of federal agencies regarding national security. The seven individuals did not understand the definition of the national security burden as it relates to many GDAIS products and services.

It was important to note that two software designers and one web technology engineer stated the organizational culture was not conducive to creating accessible products, which made the standards irrelevant to design. Their comments include “culture is tough and very conservative,” “we shy away from accommodating,” and there is “no forward thinking.” Supporting data will be discussed in subsequent questions.

Question 3: What do you think is a good approach for teaching the Section 508 standards?

The findings provide supporting data for the online training possibly improving compliance in the engineering design process. A majority (52%) of the participants stated that online training was the “appropriate” and “effective” way to teach the standards. Twelve participants added that a combination of online and instructor-led training might be better, as instructor-led training might provide more “influence” and “amplification” of the standards through “demonstrations,” and “real-life examples and workshops.” The preference for a combination approach reflects a comfort level with instructor-led training, which is common at GDAIS.

Four participants disagreed that online training was the best approach. They stated that online training was “limited,” and “torturous,” and that instructor-led training “is better” and would “reinforce ideas and force people to pay attention.” There were two different answers besides online and instructor-led training. One software designer noted that he was unsure of a good teaching approach. He noted that more managerial involvement is needed as “online doesn’t drive cultural changes.” One web technology engineer stated that “just-in-time training for a new project” might be another method to teach the standards.

Several participants including two of the three engineering managers suggested having brown-bag sessions with design engineers and staff to discuss Section 508 and adding the online training to the GDAIS required courses. These comments show a positive attitude towards the online training material and the need to provide it to a larger audience.

Question 4: What specific design knowledge or skills did you gain from the training?

Three common answers appeared. First, all stated that they increased their awareness of accommodating disabled individuals through product design. There were many similar comments such as “opened my eyes,” “very interesting,” “made me more aware of things,” and “opened my mind to different perspectives of user’s needs.” One procurement, quality assurance, and hardware engineer stated that he gained an “awareness that GDAIS does not” provide either through training, staff development, or team discussions. The increase in awareness could possibly improve the culture of GDAIS towards more inclusive products and services and potentially provide more hiring opportunities for disabled individuals.

Second, many learned the standards as related to their job responsibilities. It became clear through several responses such as “I never even heard of them” that a majority (65%) of the participants had not known of the standards despite the legal requirement to be included in contracts awarded by GSA to GDAIS. Learning and becoming aware of the standards and their specifications will provide improved compliance for design work.

Finally, many learned how to apply the standards to their jobs by using and designing accessibility features on E&IT. Engineering managers stated that they learned how to include the standards when purchasing products and in design requirements. Most of the software designers and web technology engineers stated that they learned how to apply the standards to the design of software features and web technology to various degrees. These statements included improving text readability through font size manipulation, adding table headings, providing tactile discernable controls, specifying

alternate text on images, and not using color as a primary source of information on graphs and webpages. One web technology engineer commented that adding them was not difficult by stating “how simple changes are.” Several procurement, quality assurance, and hardware engineers stated they learned “the details to apply” the standards to the purchasing of appropriate hardware and software. Future questions will provide a better understanding how the knowledge and skills gained were applied directly to product design.

Question 5: Describe how eager you were to change your behavior on the job after the training.

Participants need to return to their jobs with positive attitudes regarding the training for better results (Kirkpatrick, D. L., 2007). A majority (61%) expressed a slight eagerness to change their behavior and possibly apply the standards to their job. Many had similar comments such as “eager to change” and “reasonable to change.” Many expressed more awareness of the standards and accessibility but that the culture of the organization had reduced their eagerness and negated their interest. One commented that the standards “need to be part of the culture” while another stated “without support of management no real eagerness.” Another stated that he “would love the company to embrace the standards.” Unfortunately, while many became aware of the standards, some felt there was no reason, direction, or requirement to apply them. Seven stated that they had no eagerness to apply the standards since they did not see any reason for their application. Comments included “didn’t see any impact,” and “no application to my job.”

Many were eager to change their behavior and apply what they learned about the standards to their job responsibilities. A future question will better understand if the

majority who expressed eagerness translated to the actual application of the standards to product and services design.

Question 6: Provide an example of any application of the Section 508 standards to your work.

Two of the three software managers interviewed applied some of the standards towards decision making for accessibility. Their behaviors changed to ensure font size capabilities by commenting that the feature had proper “implementation” and that “fonts were big enough.” Additionally, one manager commented that he applied the standards to include “headers for rows and columns of tables.” One engineering manager did not apply any of the applications stating that he applies “human factor requirements that aren’t necessarily part of 508.” This response shows that while he did not apply any of the standards, human factor requirements were being applied to make products and services more usable.

The majority (64%) of software designers and procurement, quality assurance, and hardware engineers stated that they had no example of any application of the standards to their work. Three of the software designers noted similar responses that they thought about their application on many occasions. For example, “awareness but no application,” “thought about their application in powerpoint,” and “talked about project compliance during meeting.” Four of the software designers and two of the procurement, quality assurance, and hardware engineers stated that they did apply many of the standards. Four answers were common regarding how they applied the standards: font size, not using color as a primary source of information, alternate text with images, and closed-captioning. Supporting comments included “make things readable and simple,”

“tried to implement color as background not as primary means of communication,” “alternate text,” and “used closed-captioning with training material.” One procurement, quality assurance, and hardware engineer stated that he applied the standards to “output readability of drawings and printouts.”

Contrary to the majority of the software designers and procurement, quality assurance, and hardware engineers, most (four out of six) of the web technology engineers applied the standards to their work. Common among the web technology engineers responses were the application of font size and screen reader capabilities, alternate text, and the proper use of color. While the sixth question denotes if participants applied the standards, the following question highlights the reasons for participants not applying the standards to their work.

Question 7: List any reasons why you are not currently applying any of the standards.

There was one reason that nearly all gave for their lack of applying the standards. The reason was the “lack of direction” or requirements given to them by the federal customer. This directly supports GSA’s assessment results that the Section 508 standards were included in a very small percentage of federal agency E&IT solicitations (Miller, 2007). Several stated that the standards should be “part of the standard process.” With further accessibility training, managers and designers could potentially become more vocal during requirement customer meetings to discuss the inclusion of the standards.

Those who did not apply the standards gave two other reasons: “culture” and “cost.” They felt the culture of the organization was not conducive to accessibility and usability for users with differing abilities. They noted that the lack of “awareness and understanding” contributed to engineers “not being comfortable in this area so [they]

don't change." The explanation for the non-inclusive culture as a reason could be the result of the small percentage of disabled individuals employed at GDAIS in Pittsfield. Additionally, none or very little of the training provided by GDAIS includes any form of usability or accessibility discussion. One commented that the standards would be implemented because "if people have problems, people will help."

The other reason given was the additional costs incurred by the organization when implementing the standards. Participants commented these costs include "planning," "review and creation of requirements," and "features such as closed-captioning." With further education and experience, these participants will learn that disability is part of normal life and universal design is subtle and cost beneficial as many products that start out as accessible become mainstream (Story & Mueller, 2001). Additionally, Story and Mueller state that universal products may resolve issues where changes can be difficult to make and costly. The federal government and the military could value these benefits of universal design as supported by Section 508.

Question 8: Discuss how your awareness of accessibility issues has changed at work or outside of work.

All agreed that their awareness of accessibility issues has changed and improved. Many new design and information actions and concepts were noted such as accessibility options including closed-captioning, the proper use of color, adjustable volume, font size manipulation, different output and input capabilities, screen reader use, and tactile discernable buttons. Additionally, many became aware of inaccessible options in the tools and products they use and design and were interested in learning how to improve them.

Organizational actions and concepts were noted including better understanding of accessibility issues as related to business processes. These issues included more awareness of the application of the standards to proposal requirements, during governmental purchases, interviewing and the hiring process, and improving the “culture” while reducing the “gap between handicapped and normal at work.” They mentioned a small number of financial actions or concepts. These included the “need for a cost-to-benefit ratio” regarding the standards at work. Additionally, a few noted that a better understanding of cost is needed regarding products for deaf, color-blind, and poorly sighted engineers and users.

Summary

Almost all participants felt that they now understand how the Section 508 standards apply to their jobs (86%) and that the training made them more aware of accessibility issues (92%). Each subgroup reported that they learned specific knowledge and skills from the training relevant to their job responsibility in support of the standards. All learned that the standards apply to the organization as a supplier to federal agencies. A majority (71%) felt the standards were relevant to engineering design at GDAIS but only a few had examples of their application. Additionally, the reasons for the lack of the application of the standards included the lack of customer requirements, accessibility not being a part of the organizational culture, and potential costs. Behaviors and attitudes changed with an improved awareness of the needs of the disabled and those facing any human condition.

Four research questions will be answered in chapter 5 as conclusions to provide a better understanding of how online training will improve compliance for a federal vendor. Additionally, implications will be addressed for the meaning of compliance and behavior modification from online training. Finally, recommendations will be made to assist other research studies and organizations in improving universal design of products and services through training.

Chapter 5

Conclusions, Implications, Recommendations, and Summary

Section 508 of the Rehabilitation Act Amendments of 1998 took effect in 2001 and does not require companies to alter their products, but rather requires products and services to meet a set of accessibility standards developed by the USAB. Any company that would like to conduct business with the federal government must make products and services adhere to the standards. They are required by all federal agencies to provide equal access to all E&IT they develop, procure, maintain, or use. A GSA assessment resulted in only 3% of the E&IT solicitations by federal agencies included the standards (Miller, 2007). The problem identified for the case study was the deficiency of implementing the standards into the design process of GDAIS in Pittsfield, MA.

The general lack of awareness training is a major factor for low compliance (Weigelt, 2007). Choi, Yi, Law and Jacko (2006) add that legislation alone is not sufficient to modify the practices of design engineers. Ikeda and Takayanagi (2001) observe that education of professional designers is paramount to promoting and understanding universal design. The goal of the investigation was to convey universal design knowledge to managers and design engineers within GDAIS through training.

Through analysis of the data reported upon in chapter 4, the research questions are answered followed by implications of the outcomes. Recommendations are made for the organization, other federal vendors, and future studies. A summary of the investigation completes the report.

Conclusions

The major findings and conclusions following data analysis are presented:

Research Question 1: What aspects of Section 508 compliance are relevant to engineering design for suppliers of the federal government?

The standards are broken down into four subparts: general (subpart A), technical standards (subpart B), functional performance criteria (subpart C), and information, documentation, and support (subpart D) (USAB, 2000). These standards require that when federal agencies develop, procure, maintain, or use E&IT that all federal employees with or without disabilities must be able to access and use these products and services. Additionally, the USAB and Weigelt (2007) state that the standards were created so that members of the public can access and use the products and services of federal agencies. Miller (2008) adds that federal agency compliance has not improved since they became law in 2001.

Following are E&IT products covered by the standards: desktop and portable computers, software applications and operating systems, documentation and training. The USAB (2000) states that federal agencies must procure the best commercial product that meets the standards since no product in the marketplace meets all the standards. There are several economic reasons for federal suppliers to create products and services used by federal agencies that meet these standards. The National Council on Disability (2004) stated that the federal government is the most important consumer of accessibly designed products and services. The federal government acknowledges accessibility as an imperative requirement for economic and social potential (Destounis, et al., 2004). Destounis, et al., and Romano (2003) add that there is a growing population of disabled individuals whose potential for market gains and increased profit is untapped. Finally,

Keates (2006) adds that accessibility becomes more important for an organization whose aging employees will experience limited productivity due to a high possibility of functional limitations.

As a federal supplier, GDAIS obtains government contracts through the GSA, which provides assistance to federal agencies who seek procurement of E&IT. Any federal contractor that wants to do business with the government must conform to the standards. Ruby (2003) and Jaeger (2006) support this idea that a technology organization that is in business with the federal government must make accessibility in their products and services a priority. If the standards become common requirements in all products and services of an organization, then there is a greater chance of winning future government proposals and improving customer satisfaction. Organizations that improve customer satisfaction were almost 7% more productive than their competitors (Romano, 2002). Additionally, Karimi, Somers and Huhta (2001) add that an average of over \$240 million increase in market share corresponds to a 1-point increase in the customer satisfaction index.

Following standards created by the government increases technological innovation (Wang and Kim, 2007). Innovation from accessibility features increases the usability benefits for all users whether disabled or not (Gellenbeck, 2005; Reed, et al., 2004; Rose & Meyer, 2002). An organization whose products can meet as many of the standards as possible will become an innovative leader in the federal contracts market. Other General Dynamic business groups, GDC4S and GD Itronix, make an effort to develop innovative products and services that meet the standards. GD Itronix produces

both a ruggedized notebook computer and cellphone that that they claim is a major differentiator between them and their competitors

(<http://www.gd-ironix.com/index.cfm?page=Products:Accessibility>).

Employees of federal contractors must be aware of the standards to implement them within the design of products and services. Results of the literature review confirmed that the standards correlate to responsibilities of each member of a subgroup at GDAIS (<http://section508.gov/index.cfm?FuseAction=Content&ID=5>). Engineering managers at GDAIS are responsible for creating requirements of products and services when solicited by federal agencies that include the standards. Software designers and web technology engineers create, maintain, and document software and web products based on these requirements using the technical standards. Procurement, quality assurance, and hardware engineers work closely with engineering managers and the engineering staff to research, analyze, and test the best available supporting technology for GDAIS products and services.

The National Council on Disability (2009) reported to the President of the United States the status of disability policy. The report stated that access to technology has improved for disabled individuals over the last few years attributable to Section 508 and other federal laws. The application of all the standards is required since the passing of legislation in 1998 for all organizations that develop, procure, maintain, or use for the federal government. Federal vendors must meet these standards in the design of their products used by a federal agency.

Research Question 2: How did the Section 508 training improve Section 508 compliance in the engineering design process?

The findings show that the training could improve compliance through two factors. First, increased learning through positive reaction and high satisfaction. Haupt and Blignaut (2007) state that a positive reaction to the training material improves the possibility of the quantity and quality of learning. Most felt the training material was well organized, easy to understand, and the appropriate difficulty level and length. A majority of engineering managers (100%), software designers (58%), and web technology engineers (57%) recommended the training for others in the organization. Additionally, the majority agreed that online training was effective (95%) and the training itself was worth taking (86%). D. L. Kirkpatrick (2007) and Rossett (2007) add that a positive attitude by learners of the training will reinforce the material during work activities.

Most felt that the multiple-choice questions and real-life stories found within the training also positively reinforced the material and enhanced the learning. The majority of engineering managers (100%) and web technology engineers (71%) stated that they would apply what they learned to their job to improve product design and process. In addition, many software designers and web technology engineers felt that the standards would improve the design of GDAIS products and benefit the organization. It appears that their positive reactions to the training material will provide a greater chance of learning the standards and applying them to their work responsibilities. Their positive reaction to the training shows a great potential for learning and the improvement of compliance.

Second, increased learning of knowledge and skills related to Section 508 and universal design. A majority (86%) agreed or slightly agreed that the training made them

more aware of accessibility issues and the standards. Regan (2004) adds that technology designers and engineers become more comfortable with unfamiliar standards and the universal design process through training. The Section508.gov training provided knowledge and skills regarding the standards directed to each participant. All learned that the standards apply to the organization as a supplier to federal agencies. Engineering managers developed knowledge regarding compliance as related to the development of requirements, documentation of exceptions, creation of VPATs, and purchasing of computers and equipment. Software designers developed skills to provide better accessibility in products and services through the proper use of color and text and the enabling of closed-caption in multimedia. Web technology engineers gained knowledge in making web technology accessible. These skills included implementing web pages with limited flickering, textual headers for all rows and columns of tables, and the use of device-independent applets. Procurement, quality assurance, and hardware engineers learned the characteristics of an open, self-contained product.

It appears that they improved their knowledge and the skills necessary to improve compliance. The survey and test data showed the training material was effective in creating a positive attitude towards learning and increasing knowledge and skills. D. L. Kirkpatrick (2007) states that increased learning from training will provide a greater opportunity to change behavior.

Research Question 3: What observable modifications to employee behaviors concerning universal design were anticipated following training? What occurred?

Two modifications to employee behaviors were anticipated following the training. D. L. Kirkpatrick (2007) states that behavior modification relates to the transfer of

knowledge, skills, and attitudes as it applies to job responsibility. First, it was anticipated that an increase in accessibility awareness and Section 508 knowledge would occur in a majority of the participants. The increase in accessibility and awareness could produce new behaviors involving adding accessibility features in requirements and documentation, and holding technical discussions and exchanges regarding accessibility features amongst the participants. These behaviors could result in educating and modifying attitudes of those employees who did not participate in the study. Second, it was anticipated that some would apply the learned knowledge and skills towards improving compliance. Improving compliance could include the addition of the standards to project design requirements, purchasing of compliant products, and modifying the current software and web products and services to include some of the standards.

Behavioral changes occurred concerning universal design following the training. Story (2001) and Story and Mueller (2001) state there are seven principles for making the products designed to be used by all individuals. Section 508 incorporates these principles through the standards to provide E&IT to be used equally by federal employees and public users. Most participants reported an increase in accessibility awareness and knowledge. The awareness of accessibility and the standards modified the attitudes of the participants. Many stated that they were more open-minded on applying accessibility features to design and accommodating fellow employees who are disabled. Many stated the improved awareness of the lack of accessible technology, equipment, office doors and spaces, and conference rooms at the facility and the desire to recommend changes to management. Some did apply learned skills from the training to their work to improve compliance. These skills included the capability to change font size, headers for rows and

columns of tables, the proper use of color to display information, alternative text with images, availability of accessible output, use of closed-captioning for multimedia, and the proper interpretation of information through a screen reader.

These new attitudes and skills correlate to the universal design principles of equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use. The following is a brief definition of each principle:

- a. The equitable use principle defines design as being useful to people with equal or equivalent use.
- b. The flexibility in use principle defines design as accommodating a wide range of preferences and abilities especially regarding input and output.
- c. The simple and intuitive use principle defines design whose use is easy to understand with the appropriate arrangement of information.
- d. The perceptible information principle defines design whose information is effectively communicated through different modes such as pictorial and verbal.
- e. The tolerance for error principle defines design whose use minimizes consequences as the result of unintended actions.
- f. The low physical effort principle defines design that can be used with minimal repetitive use and physical effort.
- g. The size and space for approach and use principle defines design whose use is comfortable regardless of a user's body size, posture, or mobility.

Many stated that they did not modify their behavior to incorporate universal design ideas through the application of the standards into product and service design. The main reason given was the lack of customer requirements defining the standards, which supports GSA's recent assessment that only 3% of E&IT solicitations by federal agencies included the standards (Miller, 2007). D. L. Kirkpatrick (2007) adds that behavioral change will not occur until an opportunity arises. Data showed that a majority felt the standards were relevant at GDAIS (71%) and expressed an eagerness to apply what they learned to their job responsibilities (61%). With greater inclusion of the standards into design requirements from the federal customer, more behavioral changes will occur.

Research Question 4: What results did Section 508 training produce in terms of beneficial design, organizational, informational, and financial concepts or actions such as incorporating standards in contract proposals or improving accessibility awareness within the organization?

There were numerous results produced from the training besides financial ones, which reinforced the idea that other indicators besides financial numbers provide a valuable evaluation of the impact of training to business effectiveness (Haupt & Blignaut, 2007; Spitzer, 1999). Many participants stated that they lacked any knowledge or information regarding Section 508 and accessibility. They learned and improved design concepts from the training to provide better usability and accessibility. These concepts include closed-captioning, the proper use of color, adjustable volume, font size manipulation, different output and input capabilities, screen reader use, and tactile discernable buttons. From this design knowledge, many became aware of inaccessible tools used within the organization and were interested in improving them. One software designer modified a tool commonly used during code reviews to incorporate font-

changing capabilities for easier reading during meetings in large conference rooms. With gained knowledge, the participants will be more likely to implement the standards in product design and increase compliance.

Many became aware of the standards and their role for the organization. Results showed more awareness of the application of the standards to proposal requirements, during governmental purchases, and in the interview and the hiring process. Additionally, many felt that the training would improve the organizational culture. They stated that the current culture of the organization regarding training, meetings, and information did not discuss accessibility issues. Many felt that disability issues were overlooked and not part of normal conversation within the organization. The training provided a possibility to improve the organizational culture and support the disabled community through its purchases, products, and employment.

The training produced results regarding financial concepts. One manager discussed the need for the organization to provide a “cost-to-benefit ratio” application regarding the standards at work. Additionally, a few participants noted that a better understanding of cost is needed regarding products for deaf, color-blind, and poorly sighted engineers and users. The training could provide an avenue for discussion of removing cost barriers to accessibility. With a better understanding of cost regarding accessibility, engineers could see the benefit of accessibility in improving and streamlining business processes and products. Jaeger (2006) adds that the accessibility features of the standards can be easily implemented with little to no cost especially for web services.

The results regarding the training highlighted the fact that many became more aware of disability issues and the need for better accessibility of products. All stated that they are more conscience of accessibility for fellow employees and users of their products. One participant during their interview stated he was embarrassed and “felt guilty” at the lack of awareness knowledge regarding accessibility. This awareness can provide benefits for learning the standards, improving compliance, changing organizational culture towards more accessibility, and improving financial numbers by creating innovative products.

Implications

The investigation has highlighted the benefit of requiring the courses provided on the Section508.gov website. The results showed that there was a lack of knowledge and skills among the management and engineering population of a large federal vendor that is required by law to implement them. The study has validated that the Section508.gov website is a method for teaching the standards and universal design to the engineering and support staff of a federal vendor. While online teaching was considered a good approach to teach the standards, it was discovered that adding instructor-led training would have increased the value. Instructor-led training provides an environment that reinforces the material through real-life examples and workshops. It brings an expert in the field to demonstrate and discuss how the standards are implemented within a product through the design to the testing phase. Online education provides flexibility and an effective means of learning the material but can be viewed as limited in keeping the interests of the learner.

Additionally, it has shown that the training could improve compliance but does not guarantee it. It highlights that the lack of customer requirements is a major barrier to compliance. The training does provide awareness of accessibility and the needs of the disabled regarding the use of federal products and services. Once awareness is obtained, it could possibly open the door for collaboration between federal agencies and vendors to include the standards in E&IT requirements and improving compliance. Additionally, the study shows that the training increases awareness and provides a better understanding of satisfying the technological needs for an organization's disabled and aging workforce. Through following the steps of the four level model of D. L. Kirkpatrick (2007), it has contributed knowledge based on evaluating training courses for all four levels.

The conclusions gained are valuable to fields of study and educational practices. The Section 508 online training provides universal design education to a federal contractor whose business provides products to federal agencies for use by employees and the public. While the case study analyzes a specific federal vendor, the steps followed to train managers and engineers to improve compliance are applicable to other federal vendors. Additionally, the online training can be applied to other technology fields such as web technology, operating system and application development, and system testing and validation. Aside from software and computer technology matter, the training provides benefits to disciplines including management, contracts, workplace training, and human resources. Additionally, through embedded real-life examples and multimedia, the online training enhances comprehension and produces an increase in awareness regarding the needs facing the disabled population in the workforce and those that use the products and services. Furthermore, since the training meets Section 508

compliance, it serves as an example to be used by educators and trainers developing accessible online training for workers or students.

Recommendations

The investigation was designed to explore a poorly understood subject. It involved a federal vendor that was deficient in implementing the standards of Section 508 into the design process to provide accessibility. There is a need for improving compliance through education. First, GDAIS should train several individuals within each project to become requiring officers for Section 508. Requiring officers work closely with officers of federal agencies to include requirements in their proposals and assist the design team. They need to be given privileges by the organization as advocates to enforce the standards, which will reduce resistance to change. Second, GDAIS should include Section 508 training for its workforce. Managers will include the standards in requirements and purchasing equipment that meets these standards. Software designers will include on the standards to apply accessibility and universal design techniques to software of products and services. Web technology engineers will include accessibility to all web products and services designed. Procurement, quality assurance, and hardware engineers will include purchasing, testing, and validating all products and services to be used for a federal contract. The training will provide design standard education in the creation of unique and accessible products for GDAIS providing differentiation and financial benefits.

There is a need for improving the organizational culture of GDAIS to support accessibility design as evident by comments such as accessibility *resistance comes more*

from culture shock than resistance to altruism; everything about Pittsfield is circa WWII.

These improvements include more awareness in designing and purchasing accessible products for fellow employees and for end users to better meet their needs and improve productivity. Through workshops and brown-bag sessions during lunch, discussions can be held to exchange ideas of improving the organizational culture to incorporate accessibility. Additional suggestions include improving accessibility for traversing the buildings, accessing conference rooms, and using the antiquated phone system. GDAIS should invest time and effort in auditing the lack of accessibility of its facility. The facility is several decades old and does not provide wheelchair ramps or fully accessible doors to every entry and exit. The facility lacks elevators to each floor, which leaves many conference rooms inaccessible to disabled employees.

Studies of a similar nature could be used by federal agencies to improve their inclusion of the standards within E&IT solicitations. The standards were taught through online training and the training evaluated through validated surveys, tests, and interviews. The locally developed survey, test, and interview instruments could be used as a reference point for evaluating Section 508 training of given populations of employees based on their job responsibilities. Additionally, the support and engineering staff of state governments could use the procedure to teach the standards and increase compliance. Huffman, Uslan, Burton, and Eghtesadi (2009) stated that more than 20 states have implemented the law.

For any federal agency, state government, or private organization that intends to implement Section 508 training for compliance, further recommendations are suggested as learned through experience:

1. Provide incentives to participants in future initiatives to increase the number of participants who complete the training, survey, test and interview
2. Conduct a portion of the training through an instructor to determine if compliance improves
3. Include different questions in the instruments to better understand how accessibility training and compliance influences organizational culture.
4. Involve participants from the financial and research and development departments to gain a better understanding of how the application of the standards affects the return-on-investment for an organization through differentiation or innovation.

There are several recommendations for future research regarding Section 508 compliance and universal design. Research might address how compliance improves and creates innovative products. There are endless possibilities for universally designed products for the military. For example, military personnel in combat that face a disability such as blindness or the loss of a limb can still function and complete their mission. Universally designed products can be used to improve training materials and military actions such as clandestine operations in a foreign land with limited electricity using only tactile buttons. Other fields that should research the relationship between compliance and innovation include education, medicine, and electronic government. Second, it is important to address how organizational culture affects compliance especially when comparing engineering facilities in metropolitan cities with those located in rural and

secluded areas such as Pittsfield, MA. Such research could influence training design to improve compliance and universal design.

Other research could analyze the possible effects besides compliance for organizations and institutions that implement the Section 508 standards in their products and services. These effects could include winning more proposals from the government, hiring more disabled individuals, supporting an aging workforce, and creating innovative technology to assist the disabled outside the government realm. Future case studies could provide improvements to the standards and added support to the value of their implementation for the government and the public.

Summary

The Section 508 standards are part of the Rehabilitation Act Amendments of 1998, which requires compliance by federal agencies when procuring, designing, and maintaining electronic and information technology. The standards provide encouragement for universal design and inclusion of the disabled. Rose and Meyer (2002) defined universal design as the creation of products that accommodate the needs of all users regardless of physical and mental abilities. Universal design is accomplished by following seven principles: Equitable use, flexibility in use, simple and intuitive use, perceptible information, tolerance for error, low physical effort, and size and space for approach and use (Story & Mueller, 2001).

The USAB (2000) states that federal vendors that would like to conduct business with federal agencies must make their products and services adhere to these standards. Low compliance to Section 508 was due in large part to the lack of awareness training

(Weigelt, 2007). The investigation analyzed the possible effects of computer-based awareness training for a federal vendor whose products and services are solicited by agencies of the federal government. The training attempted to correct the lack of compliance in the engineering design process, increase accessibility awareness, and provide organizational benefits to the federal vendor. Ikeda and Takayanagi (2001) and Regan (2004) support improving technology designers' understanding of unfamiliar standards and the universal design process through training.

The federal vendor was a branch of GDAIS located in Pittsfield, MA. Sixty-one individuals consented to taking four hours of online training courses from the Section508.gov website between March 30 and April 14, 2009. The participants took courses according to their job responsibilities at GDAIS. The job responsibilities were broken into four subgroups regarding the design, development, purchase, and documentation of E&IT products or services:

1. Engineering managers work with federal customers to develop requirements.
2. Software designers create software and documenting procedures.
3. Web technology engineers develop websites or web technology.
4. Procurement, quality assurance, and hardware engineer support, evaluate, and procure equipment.

Thirty-seven participants completed the online post-training survey. It consisted of five sections of questions to evaluate the training and to show understanding of how the training could improve compliance. Thirty-five then completed a short seven question online test. The test reinforced the lessons learned from the training material and represented actual job situations. Several months after training was completed in June

2009, interviews of 31 participants were conducted to understand changes to job behavior. The survey, test, and interview followed the Kirkpatrick (2007) model for evaluating training and its effect on individuals and the organization. The survey and test were created in and accessed through the online survey tool available at zoomerang.com. Each instrument was validated and deemed reliable through a panel of experts and pilot-testing as recommended by Leedy and Ormrod (2005) and Gay and Airasian (2003).

Data were collected from the current Section 508 and accessibility literature and the survey, test, and interview instruments to answer the four research questions:

1. What aspects of Section 508 compliance are relevant to engineering design for suppliers of the federal government?
2. How did the Section 508 training improve Section 508 compliance in the engineering design process?
3. What observable modifications to employee behaviors concerning universal design were anticipated following training? What occurred?
4. What results did Section 508 training produce in terms of beneficial design, organizational, informational, and financial concepts or actions such as incorporating standards in contract proposals or improving accessibility awareness within the organization?

Analysis of the data produced specific patterns, themes, and meaning as recommended by Leedy and Ormrod (2005) and Spitzer (1999). Major findings from the data sources resulted in several conclusions:

1. Application of the standards must be applied to E&IT developed, procured, maintained, or used by federal agencies for use by employees and the public.

2. Potential market gains, increased profitability, improved innovation, and productivity support of the aging workforce are additional reasons for federal vendors to meet compliance.
3. The participants increased their accessibility and universal design knowledge.
4. The participants learned the standards and improved design concepts through better usability and accessibility features.
5. As found by Miller (2007), data supported the GSA's assessment regarding the lack of Section 508 inclusion within solicitations by federal agencies.
6. The organizational culture to support the disabled community showed a possibility of improving through awareness and education.

A case study has value for teaching the standards and improving compliance for other federal vendors, federal agencies, state governments, and academic institutions that implement the law or work with the government. Yin (2004) stated that governmental actions at the federal level are common subjects of case studies. The survey, test, and interview instruments may be used to evaluate Section 508 training for all four levels of the D. L. Kirkpatrick (2007) model.

Recommended to improve future research are to provide incentives to participants to increase participation and to conduct instructor-led training along with CBT courses. Implementing these recommendations will produce additional evidence correlating the standards with military innovation, organizational culture improvement towards the disabled, and financial improvements for corporations.

Appendices

Appendix A

Section508.gov Courses

Buying Accessible E&IT Course

The screenshot shows a web browser window displaying the Section 508 website. The browser title is "Section 508: The Road to Accessibility - Mozilla Firefox". The address bar shows the URL: <https://www.section508.gov/training/index.cfm?FuseAction=LessonMenu&CourseID=3>. The page header features the Section 508 logo and the website URL www.section508.gov.

The main content area is titled "508 Universe Menu" and includes the following sections:

- Logged In: manager**
- My Account**
 - [Modify My Profile](#)
 - [View Transcript](#)
 - [Send Feedback](#)
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- My 508 Universe**
 - [508 Training Courses](#)
 - [Resources](#)
 - [Glossary](#)
- Support**
 - [Accessibility Concerns](#)
 - [System Requirements](#)
 - [Navigating the Universe](#)
- [Logout](#)

The course page is titled "Buying Accessible E & IT" and lists the following "Course Lessons":

- [It's the Law! \(15 minutes\) | Print](#)
- [Disabilities and Accessibility \(20 minutes\) | Print](#)
- [508 and the Procurement \(40 minutes\) | Print](#)

At the bottom of the page, there are several links: [Back to Top](#), [Section 508 Home](#), [Comments for the Webmaster](#), [Privacy Statement](#), and [Plug-Ins](#). Below these links is the text "Accessibility (04/30/2008) OGP-CIO".

The footer contains logos for "TAKE PRIDE IN AMERICA", "CIO COUNCIL", "eStrategy eGov Strategies", "ExpectMore.gov", and "USA.gov Government Made Easy".

The browser status bar at the bottom shows "Done", the website URL www.section508.gov, and weather information: "Now: Mostly Cloudy, 27° F", "Tue: 33° F", and "Wed: 30° F".

Section 508: The Road to Accessibility - Mozilla Firefox

File Edit View History Bookmarks Tools Help

https://www.section508.gov/training/index.cfm?FuseAction=LessonPages&LessonID=19

Google

Section 508

www.section508.gov

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Course: [Buying Accessible E & IT](#) Lesson: [508 and the Procurement](#) Page 1 of 41

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In this lesson you'll learn how section 508 impacts the procurement of goods and services. Upon completion of the lesson, you'll be able to:

- Describe the responsibilities of the Requiring Official.
- Describe the responsibilities of the Contracting Officer.
- List contract actions that will trigger 508, and those that won't.
- Explain the implications for failure to comply with 508.
- Determine if a buy is E & IT.
- Determine whether an exception applies to a buy.
- Review Access Board standards and determine which apply to a purchase.
- Identify resources for conducting market research, and describe the extent to which market research should be conducted.
- Define undue burden, commercial non-availability, and equivalent facilitation.
- List what should be contained in technical specifications.



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Building and Buying Accessible Software

The screenshot shows a Mozilla Firefox browser window displaying the website <https://www.section508.gov>. The page title is "Section 508: The Road to Accessibility". The main navigation menu includes "508 Universe Menu".

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Building and Buying Accessible Software

Course Lessons

- It's the Law! (15 mins.) | Print
- Disabilities and Accessibility (20 mins.) | Print
- Introduction to Accessible Software (15 mins.) | Print
- User Interaction (25 mins.) | Print
- Compatibility with Accessibility Features and Settings (15 mins.) | Print
- Using Graphical and Textual Elements (20 mins.) | Print
- Examining Software for Conformance with Section 508 (20 mins.) | Print

Navigation links: [Back to Top](#) | [Section 508 Home](#) | [Comments for the Webmaster](#) | [Privacy Statement](#) | [Plug-Ins](#)

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Logos: TAKE PRIDE IN AMERICA, CIO COUNCIL, eStrategy eGov Strategies, ExpectMore, USA.GOV Government Made Easy

System tray: Done, www.section508.gov, Now: Mostly Cloudy, 30° F, Thu: 37° F, Fri: 28° F

Designing Accessible Websites

The screenshot shows a Mozilla Firefox browser window displaying the website www.section508.gov. The page title is "Section 508: The Road to Accessibility". The main navigation menu includes "508 Universe Menu".

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Designing Accessible Web Sites

Course Lessons

- It is the Law (15 minutes) | Print
- Disabilities and Accessibility (20 minutes) | Print
- Designing to the Standards (64 minutes) | Print
- Frames and Style Sheets (28 minutes) | Print
- Alternatives for Multimedia (25 minutes) | Print
- Scripts and Applets (25 minutes) | Print
- On-Line Forms and Adobe PDF Files (22 minutes) | Print
- Validation (20 minutes) | Print

Navigation links: [Back to Top](#) | [Section 508 Home](#) | [Comments for the Webmaster](#) | [Privacy Statement](#) | [Plug-Ins](#) | [Accessibility \(04/30/2008\) OGP-CIQ](#)


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System tray: Done, www.section508.gov, Now: Mostly Cloudy, 30° F, Thu: 37° F, Fri: 28° F

Section 508: The Road to Accessibility - Mozilla Firefox

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https://www.section508.gov/training/index.cfm?FuseAction=LessonPages&LessonID=3

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www.section508.gov

508 Universe Menu

Logged In: **manager** Course: [Designing Accessible Web Sites](#) Lesson: [Designing to the Standards](#) Page 1 of 60

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- ➔ [Navigating the Universe](#)

➔ [Logout](#)

In this lesson, you'll learn basic techniques for designing Web pages that are compliant with section 508. When you're finished with this lesson you should be able to:






- Identify why Web pages should be accessible using only the keyboard.
- Use non-text elements that comply with the section 508 standards.
- Design accessible HTML tables for data and layout.
- Design and use image maps and other navigational elements in compliance with section 508.
- Use color in compliance with section 508.



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Buying Accessible Telecommunications Products

Section 508: The Road to Accessibility - Mozilla Firefox

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Section 508
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Buying Accessible Telecommunications Products

Course Lessons

- Introduction to Telecommunications ((15 mins.)) | Print
- Telecommunications Product Accessibility for TTY Users ((20 mins.)) | Print
- Telecommunications Product Accessibility for people with Hearing Loss ((20 mins.)) | Print
- Requirement for Caller ID and Response Time ((20 mins.)) | Print
- Mechanically Operated Controls and Keys ((20 mins.)) | Print
- Applying the Standard to Telecommunications Product Procurements ((15 mins.)) | Print

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Accessible Video and Multimedia

Section 508: The Road to Accessibility - Mozilla Firefox

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Section 508
www.section508.gov

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→ [Logout](#)

Accessible Video and Multimedia

Course Lessons

- [It's the Law! \(15 minutes\) | Print](#)
- [Disabilities and Accessibility \(20 minutes\) | Print](#)
- [Video and Multimedia Accessibility Standards \(25 minutes\) | Print](#)
- [Captioning Pre-recorded and Live Video and Multimedia \(26 minutes\) | Print](#)
- [Audio Describing Video and Multimedia \(32 minutes\) | Print](#)

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www.section508.gov

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Thu: 37° F

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Section 508: The Road to Accessibility - Mozilla Firefox

File Edit View History Bookmarks Tools Help

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Section 508
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Logged In: **manager** Course: [Accessible Video and Multimedia](#) Lesson: [Audio Describing Video and Mul...](#) Page 2 of 31

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Logout

In this lesson you'll learn how to:






- Determine what parts of a video or multimedia product need to include audio descriptions.
- Identify possible methods of including additional audio information to increase the accessibility of computer-based multimedia products.
- Describe how to audio describe a live event.
- Check an audio described product for accuracy.



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Opening Closed Products

The screenshot shows a Mozilla Firefox browser window displaying the Section 508 website. The address bar shows the URL: <https://www.section508.gov/training/Index.cfm?FuseAction=LessonMenu&CourseID=9>. The page header features the Section 508 logo and the text "Section 508 www.section508.gov".

The main content area is titled "508 Universe Menu" and includes a sidebar with navigation options and a main section for "Opening Closed Products".

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Opening Closed Products

Course Lessons

- [It's the Law! \(15 mins.\) | Print](#)
- [Disabilities and Accessibility \(20 mins.\) | Print](#)
- [Introduction to Self contained, Closed Products and Accessibility \(15 mins.\) | Print](#)
- [Physical Features of Closed Products \(15 mins.\) | Print](#)
- [Interacting with Closed Products \(15 mins.\) | Print](#)
- [Outputs from Closed Products \(15 mins.\) | Print](#)
- [Purchasing Self contained, Closed Products \(15 mins.\) | Print](#)

Footer links: [Back to Top](#) | [Section 508 Home](#) | [Comments for the Webmaster](#) | [Privacy Statement](#) | [Plus-Ins](#)

Accessibility (04/30/2008) OGP-CIQ

Logos: TAKE PRIDE IN AMERICA, CIO COUNCIL, eStrategy eGov Strategies, ExpectMore, USA.gov Government Made Easy

System tray: Waiting for www.section508.gov... | www.section508.gov | Now: Mostly Cloudy, 30° F | Thu: 37° F | Fri: 28° F

Section 508: The Road to Accessibility - Mozilla Firefox

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Section 508

www.section508.gov

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- [Navigating the Universe](#)

→ [Logout](#)

At the end of this lesson, you'll be able to:






- Explain what is and what is not covered under the provisions for self contained, closed products.
- Describe how non-conformance with the section 508 standards can affect someone with a disability.



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Buying Accessible Computers

The screenshot shows a Mozilla Firefox browser window displaying the website www.section508.gov. The page title is "Section 508: The Road to Accessibility". The browser's address bar shows the URL: <https://www.section508.gov/training/index.cfm?FuseAction=LessonMenu&CourseID=8>.

The website header features the "Section 508" logo and the URL www.section508.gov. Below the header is a "508 Universe Menu" with the following sections:

- Logged In: manager**
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- My 508 Universe**
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 - Navigating the Universe
- Logout

The main content area is titled "Buying Accessible Computers" and lists "Course Lessons":

- It's the Law! (15 mins.) | Print
- Disabilities and Accessibility (20 mins.) | Print
- Introduction to Desktop and Portable Computers (15 mins.) | Print
- Mechanically operated, Touch, and Biometric Controls (25 mins.) | Print
- Connectors (15 mins.) | Print
- Applying the Standards to Computer Procurements (15 mins.) | Print

At the bottom of the page, there are navigation links: [Back to Top](#), [Section 508 Home](#), [Comments for the Webmaster](#), [Privacy Statement](#), and [Plug-Ins](#). Below these links is the text "Accessibility (04/30/2008) OGP-CIO".

The footer contains several logos: TAKE PRIDE IN AMERICA, CIO COUNCIL, eStrategy eGov Strategies, ExpectMore, and USA.GOV Government Made Easy.

The browser's status bar at the bottom shows "Done", the URL www.section508.gov, and weather information: "Now: Mostly Cloudy, 30° F", "Thu: 37° F", "Fri: 28° F".

Appendix B

Participant Consent Letter



Consent Form for Participation in the Research Study Entitled
Section 508 Adherence by Industry Professionals: Improving Universal Design through
Training

Funding Source: None.

IRB approval # (wang02150902)

Principal investigator(s)

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Co-Investigator(s)

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Office of Grants and Contracts
(954) 262-5369/Toll Free: 866-499-0790
IRB@nsu.nova.edu

General Dynamics AIS

100 Plastics Avenue
Pittsfield, MA 01201

Description of the Study:

I am implementing a computer-based training program for design engineers and managers within GDAIS to foster universal design skills and increase accessibility awareness. I have been an employee of GD for over 12 years. You are invited to participate in a study of the Section 508 standards as part of my doctoral research at Nova Southeastern University. I appreciate your willingness to assist me in my effort fully and honestly.

Section 508 of the Rehabilitation Act Amendments of 1998 took effect in 2001 and provides encouragement for universal design and compliance requirements to the federal sector for purchases that must meet the accessible usage of people with disabilities. Any company that would like to conduct business with the U.S. government must make products and services adhere to these standards.

Initials: _____ **Date:** _____

Page 1 of 3

Several leaders of the GDAIS administration have supported through letters the potential importance for the organization. These leaders include the ICS Director of Engineering and Engineering Council Chair, Mr. David M. Markham, the Senior Manager of Software Engineering, Mr. David M. Prenguber, and a Technical Manager of Software Engineering, Mr. Ronald S. Mauk.

Improving awareness is important at GDAIS in order to increase its federal sales market share, develop new products and services, transfer technology to other fields, and support a global market for users with different human conditions. Within a typical engineering group at General Dynamics AIS, there are a manager, a procurement engineer, an administrative assistant, two quality assurance engineers, five hardware engineers, five web technology engineers, and 15 software designers. Each potential participant has one of these titles depending on their job responsibility.

As a participant, on your own time, you will:

- Complete two to four hours of training courses
- Take a brief survey and a small multiple-choice test
- Engage in a brief interview session with me two months after training

Risks /Benefits to the Participant:

The training should be completed within a two-week period and is unlikely to result in computer stress or anxiety. The study will provide the benefit of free training of the Section 508 standards. Contact me or the IRB office at the addresses above with any concerns.

Costs and Payments to the Participant:

There are no costs to you or payments associated with participation.

Confidentiality and Privacy:

All information obtained in this study is strictly confidential unless disclosure is required by law. The data collected from the survey and test tools on zoomerang.com are anonymous. Zoomerang.com guarantees anonymity of the data through utilizing the direct URL link of the survey and test. Additionally, all data from zoomerang.com will be downloaded with the checkbox "include respondent email addresses" unchecked which keeps the data anonymous. During the interview session, no names will be used or written on the interview forms for collecting data. All data will be used for statistical and summary purposes only and names or email addresses will not be associated protecting your privacy and confidentiality. The IRB and regulatory agencies may review research records.

Initials: _____ **Date:** _____

Use of Protected Health Information (PHI):

This study does not require the disclosure of any Protected Health Information.

Participant's Right to Withdraw from the Study:

You have the right to refuse to participate or to withdraw at any time, without penalty. If you do withdraw, it will not affect you in any way. If you choose to withdraw, you may request that any of your data which has been collected be destroyed unless prohibited by state or federal law.

Other Considerations:

If significant new information relating to the study becomes available, which may relate to your willingness to continue to participate, this information will be provided to you by Antonio Rincon through an electronic email.

Voluntary Consent by Participant:

I have read the preceding consent form, or it has been read to me, and I fully understand the contents of this document and voluntarily consent to participate in the research study entitled "Section 508 Adherence by Industry Professionals: Improving Universal Design through Training." All of my questions concerning the research have been answered. I hereby agree to participate in this research study. If I have any questions in the future about this study they will be answered by Antonio Rincon. A copy of this form has been given to me. This consent ends at the conclusion of this study.

Participant's Signature: _____ Date: _____

Witness' Signature: _____ Date: _____

Appendix C

Participant Instructions

Please follow the steps listed below:

1. Click on the link and register with your information
<http://www.section508.gov/index.cfm?FuseAction=RegisterUniverse>

The screenshot shows a Microsoft Internet Explorer browser window displaying the 'Section 508: The Road to Accessibility' website. The address bar shows the URL: <http://www.section508.gov/index.cfm?FuseAction=RegisterUniverse>. The page title is 'Section 508: The Road to Accessibility - Microsoft Internet Explorer'. The website header includes the 'Section 508' logo and the URL 'www.section508.gov'. A navigation menu contains links for '508 Law', '508 & You', '508 Training', '508 Coordinators', 'Accessibility Forum', 'FAQs', 'Events', and 'Help'. A search bar is located on the left side of the page. The main content area is titled '508 Universe Training - New User Registration Form'. It features a 'New User Registration Form (* Required Field)' with the following fields: First Name, Last Name, User Name, Password, E-mail Address, and Phone Number. A 'Submit' button is located below the form. On the right side of the form, there are two red text notices: 'If you have already registered for the 508 Universe please click this link.' with a 'Secure Login' link, and 'If you have never registered for the 508 Universe before please click this link.' with a 'Register For 508 Universe' link. Below these notices is a 'Printer Friendly' link. At the bottom of the page, there are several logos: 'TAKE PRIDE IN AMERICA', 'CIO COUNCIL', 'eStrategy eGov Strategies', 'ExpectMore', and 'USA.gov Government Made Easy'. The footer also includes links for 'Back to Top', 'Section 508 Home', 'Comments for the Webmaster', 'Privacy Statement', and 'Plug-Ins', along with an 'Accessibility (04/30/2008) OGP-CIO' statement.

NOTE: This information will not be available to the researcher. Privacy rules for the Section508.gov website are available at
<http://www.section508.gov/index.cfm?FuseAction=Content&ID=10>

2. Once registration is complete, click the login button.

The screenshot shows a Microsoft Internet Explorer browser window displaying the website <https://www.section508.gov/index.cfm?FuseAction=RegUniverse>. The page features the Section 508 logo and navigation links such as "508 Law", "508 & You", "508 Training", "508 Coordinators", "Accessibility Forum", "FAQs", "Events", and "Help".

The main content area is titled "Thank You" and contains the following text:

Your registration was submitted successfully. Within moments you should receive an e-mail at the e-mail address you provided. The email should contain your registered username and password, which will be needed to log into the 508 Universe in the future. If you should need any further assistance, please send an e-mail to the [508 Universe Administrator](#) with a brief description of your concern.

To continue and enter the 508 Universe, select the [Login](#) button below.

There are two columns of text on the right side of the page:

- Secure Login:** "If you have already registered for the 508 Universe please click this link." with a link to [Secure Login](#).
- Register For 508 Universe:** "If you have never registered for the 508 Universe before please click this link." with a link to [Register For 508 Universe](#).
- User Guidance:** "Having problems with the 508 Universe? Review the [User Guidance](#)."

Below the main content, there is an "Icon Key" section with buttons for "508 Template", "Save Item", and "Printer Friendly".

At the bottom of the page, there are several logos and links:

- Links: [Back to Top](#), [Section 508 Home](#), [Comments for the Webmaster](#), [Privacy Statement](#), [Plug-Ins](#)
- Accessibility (04/30/2008) OGP-CIO
- Logos: TAKE PRIDE IN AMERICA, CIO COUNCIL, eStrategy eGov Strategies, ExpectMore, USA.gov Government Made Easy

3. Click on the link entitled “508 Training Courses” on the left hand side of the website.

The screenshot shows a Microsoft Internet Explorer browser window displaying the website <https://www.section508.gov/section508/training/index.cfm>. The page header includes the "Section 508" logo and the URL www.section508.gov. Below the header is a "508 Universe Menu" section. The user is logged in as "manager".

The left-hand navigation menu is organized into several sections:

- My Account**
 - Modify My Profile
 - View Transcript
 - Send Feedback
 - My FrontPage
- My 508 Universe** (highlighted with a red circle and a red arrow pointing to it)
 - 508 Training Courses** (highlighted with a red circle)
 - Resources
 - Glossary
- Support**
 - Accessibility Concerns
 - System Requirements
 - Navigating the Universe
 - Logout

The main content area displays a welcome message: "Welcome, joe smith to the 508 Universe." followed by a link: [What do you think of the new 508 Universe?](#)

The main content area contains the following text:

This is your source for learning how your agency meets the requirements of section 508 of the Rehabilitation Act as amended by the Workforce Reinvestment Act of 1998. Here you'll find information and Web based training courses on various topics. You can also download the presentation materials and instructor and participant guides for available classroom courses.

Read the [System Requirements](#) on the Help page to maximize your experience in the 508 Universe.

In the "My 508 Universe" area, you can click on "Refresh This Information" to update your course information.

We are always interested in comments that help us increase the accessibility of the site. We encourage you to use the form in the [Feedback](#) area to submit questions, comments, or concerns.

Please remember to [Logout](#) when finished. The logout link is located on the lower left hand side of the site.

Below the main content area, there are two summary boxes:

- My Account**
 - Has your email changed? [Modify your profile](#)
 - This is your **3rd** login
 - Your last login is Not Available
- My 508 Universe**
 - You have completed **0** total courses
 - Current Course: Not Available
 - You have completed no lessons
 - [Refresh This Information](#)

At the bottom of the page, there are navigation links: [Back to Top](#) | [Section 508 Home](#) | [Comments for the Webmaster](#) | [Privacy Statement](#) | [Plug-Ins](#) |

Below the navigation links is the text: Accessibility (04/30/2008) OGP-CIO

At the bottom of the page, there are logos for: TAKE PRIDE IN AMERICA, CIO COUNCIL, eStrategy eGov Strategies, ExpectMore, and USA.gov Government Made Easy.

4. Please complete the course(s) listed below within 14 days:

(For Engineering Managers):

Buying Accessible E&IT and Buying Accessible Computers

(For Software Designers):

Building and Buying Accessible Software and Accessible Video and Multimedia

(For Web Technology Engineers):

Designing Accessible Websites

(For Procurement, Quality Assurance, and Hardware Engineers):

Buying accessible telecommunications products and Opening closed products

The screenshot shows a web browser window titled "Section 508: The Road to Accessibility - Microsoft Internet Explorer". The address bar shows the URL: <https://www.section508.gov/section508/training/index.cfm?FuseAction=LearningCenter>. The page content includes a "508 Universe Menu" on the left with sections for "My Account", "My 508 Universe", and "Support". The main content area is titled "508 Training Courses" and lists various courses with their durations. The courses listed are:

- Designing Accessible Web Sites (4 hours)
- Accessible Conferences (2 hours)
- Buying Accessible E & IT (1.25 hours)
- Section 508 Coordinators (1.5 hours)
- Additional Accessibility & Usability Concerns (1.25 hours)
- Accessible Video and Multimedia (2.5 hours)
- Building and Buying Accessible Software (2 hours)
- Buying Accessible Computers (1.5 hours)
- Opening Closed Products (1.5 hours)
- Micro-purchases and Section 508 (15 minutes)
- Buying Accessible Telecommunications Products (1 hour 50min)

Other Agency Resources:

- IRS - Section508 for Software Development

At the bottom of the page, there are navigation links: [Back to Top](#), [Section 508 Home](#), [Comments for the Webmaster](#), [Privacy Statement](#), and [Plug-Ins](#). The footer includes logos for "TAKE PRIDE IN AMERICA", "CIO COUNCIL", "eStrategy eGov Strategies", "ExpectMore", and "USA.gov Government Made Easy".

NOTE: You may leave and return to a course. You can click the current course when you next log into the Section508.gov website (see example below).

The screenshot shows a Microsoft Internet Explorer browser window displaying the Section 508 website. The address bar shows the URL: <https://www.section508.gov/training/index.cfm>. The page header features the Section 508 logo and the text "Section 508 www.section508.gov".

The main content area is titled "508 Universe Menu" and includes a navigation menu on the left with sections: "My Account", "My 508 Universe", and "Support". The "My Account" section is expanded, showing the following information:

- My Account**
 - Has your email changed? [Modify your profile](#)
 - This is your **5th** login
 - Your last login was **December 15, 2008 at 3:26 PM**
- My 508 Universe**
 - You have completed **0** total courses
 - Current Course: [Buying Accessible E & IT](#) (circled with an arrow)
 - You have completed **2 of 3** lessons in your course
 - [Refresh This Information](#)

The page also includes a "Welcome, joe smith to the 508 Universe." message and a link to "What do you think of the new 508 Universe?". At the bottom, there are navigation links: "Back to Top", "Section 508 Home", "Comments for the Webmaster", "Privacy Statement", and "Plug-Ins". Logos for "TAKE PRIDE IN AMERICA", "CIO COUNCIL", "eStrategy eGov Strategies", "ExpectMore", and "USA.gov" are displayed at the bottom.

5. Upon completion of the courses, click on the “MyFrontPage” link on the left hand side of the website page and verify the courses have been completed. See example below:

The screenshot shows a Microsoft Internet Explorer browser window displaying the website <https://www.section508.gov/training/index.cfm>. The page title is "Section 508: The Road to Accessibility". The user is logged in as "manager". The "508 Universe Menu" is visible on the left, with "My FrontPage" circled and an arrow pointing to it. The main content area shows a welcome message for "joe smith" and a "My Account" section with the following details:

- Has your email changed? [Modify your profile](#)
- This is your **5th** login
- Your last login was **December 15, 2008 at 3:26 PM**

The "My 508 Universe" section shows:

- You have completed **1** total courses
- Current Course: [Buying Accessible E & IT](#)
- You have completed **3 of 3** lessons in your course
- [Refresh This Information](#)

At the bottom of the page, there are navigation links: [Back to Top](#), [Section 508 Home](#), [Comments for the Webmaster](#), [Privacy Statement](#), and [Plug-Ins](#). The footer includes logos for "TAKE PRIDE IN AMERICA", "CIO COUNCIL", "eStrategy eGov Strategies", "ExpectMore", and "USA.gov Government Made Easy".

6. Once **ALL** courses are completed, please complete the following survey by clicking the following link: ZOOMERANG SURVEY URL
(Survey URL will differ for each of the four subgroups of the participants)
7. Upon completion of the survey, please complete the following short multiple-choice test: ZOOMERANG TEST URL
(Test URL will differ for each of the four subgroups of the participants)

Appendix D

Participant Surveys

Engineering Manager Survey

Questions	Agree					Disagree
Training Design						
• The goals were clearly communicated and met my satisfaction.	5	4	3	2	1	
• The topics were well organized and easy to understand.	5	4	3	2	1	
• The length of the training was appropriate for the topics covered.	5	4	3	2	1	
• The level of difficulty of the content was appropriate for me.	5	4	3	2	1	
Course Objectives						
• The training made me more aware of accessibility issues.	5	4	3	2	1	
• The training made me more aware of the Section 508 standards.	5	4	3	2	1	
• I learned how to apply the Section 508 standards to our procurement process.	5	4	3	2	1	
• I learned the technical requirements that computer systems must meet in order to be Section 508 compliant.	5	4	3	2	1	
Other Aspects of the Training						
• The multiple-choice questions reinforced ideas of the training material.	5	4	3	2	1	
• The real-life stories enhanced my learning of the material.	5	4	3	2	1	
• Conducting the training online provides an effective learning environment.	5	4	3	2	1	
Overall Rating						
• The training was worth taking.	5	4	3	2	1	
Training Applications						
• I will apply what I learned in this training to my job.	5	4	3	2	1	

<ul style="list-style-type: none"> • I would recommend this training for others in the organization. 	5	4	3	2	1
<ul style="list-style-type: none"> • I believe the Section 508 standards will improve the design of the products for my organization. 	5	4	3	2	1
<ul style="list-style-type: none"> • I believe the organization I work for will benefit from following the Section 508 standards. 	5	4	3	2	1
Comments					
<ul style="list-style-type: none"> • How could the training be improved? 					

Software Designer Survey

Questions	Agree					Disagree
Training Design						
<ul style="list-style-type: none"> • The goals were clearly communicated and met my satisfaction. 	5	4	3	2	1	
<ul style="list-style-type: none"> • The topics were well organized and easy to understand. 	5	4	3	2	1	
<ul style="list-style-type: none"> • The length of the training was appropriate for the topics covered. 	5	4	3	2	1	
<ul style="list-style-type: none"> • The level of difficulty of the content was appropriate for me. 	5	4	3	2	1	
Course Objectives						
<ul style="list-style-type: none"> • The training made me more aware of accessibility issues. 	5	4	3	2	1	
<ul style="list-style-type: none"> • The training made me more aware of the Section 508 standards. 	5	4	3	2	1	
<ul style="list-style-type: none"> • I learned general design techniques for ensuring software accessibility. 	5	4	3	2	1	
<ul style="list-style-type: none"> • I learned how to add accessibility features to multimedia. 	5	4	3	2	1	
Other Aspects of the Training						
<ul style="list-style-type: none"> • The multiple-choice questions reinforced ideas of the training material. 	5	4	3	2	1	
<ul style="list-style-type: none"> • The real-life stories enhanced my learning of the material. 	5	4	3	2	1	
<ul style="list-style-type: none"> • Conducting the training online provides an effective learning environment. 	5	4	3	2	1	

Overall Rating					
<ul style="list-style-type: none"> The training was worth taking. 	5	4	3	2	1
Training Applications					
<ul style="list-style-type: none"> I will apply what I learned in this training to my job. 	5	4	3	2	1
<ul style="list-style-type: none"> I would recommend this training for others in the organization. 	5	4	3	2	1
<ul style="list-style-type: none"> I believe the Section 508 standards will improve the design of the products for my organization. 	5	4	3	2	1
<ul style="list-style-type: none"> I believe the organization I work for will benefit from following the Section 508 standards. 	5	4	3	2	1
Comments					
<ul style="list-style-type: none"> How could the training be improved? 					

Web Technology Engineer Survey

Questions	Agree					Disagree				
Training Design										
<ul style="list-style-type: none"> The goals were clearly communicated and met my satisfaction. 	5	4	3	2	1					
<ul style="list-style-type: none"> The topics were well organized and easy to understand. 	5	4	3	2	1					
<ul style="list-style-type: none"> The length of the training was appropriate for the topics covered. 	5	4	3	2	1					
<ul style="list-style-type: none"> The level of difficulty of the content was appropriate for me. 	5	4	3	2	1					
Course Objectives										
<ul style="list-style-type: none"> The training made me more aware of accessibility issues. 	5	4	3	2	1					
<ul style="list-style-type: none"> The training made me more aware of the Section 508 standards. 	5	4	3	2	1					
<ul style="list-style-type: none"> I learned how to make web technology accessible. 	5	4	3	2	1					
Other Aspects of the Training										
<ul style="list-style-type: none"> The multiple-choice questions reinforced ideas of the training 	5	4	3	2	1					

material.					
• The real-life stories enhanced my learning of the material.	5	4	3	2	1
• Conducting the training online provides an effective learning environment.	5	4	3	2	1
Overall Rating					
• The training was worth taking.	5	4	3	2	1
Training Applications					
• I will apply what I learned in this training to my job.	5	4	3	2	1
• I would recommend this training for others in the organization.	5	4	3	2	1
• I believe the Section 508 standards will improve the design of the products for my organization.	5	4	3	2	1
• I believe the organization I work for will benefit from following the Section 508 standards.	5	4	3	2	1
Comments					
• How could the training be improved?					

Procurement, Quality Assurance, Hardware Engineer Survey

Questions	Agree					Disagree
Training Design						
• The goals were clearly communicated and met my satisfaction.	5	4	3	2	1	
• The topics were well organized and easy to understand.	5	4	3	2	1	
• The length of the training was appropriate for the topics covered.	5	4	3	2	1	
• The level of difficulty of the content was appropriate for me.	5	4	3	2	1	
Course Objectives						
• The training made me more aware of accessibility issues.	5	4	3	2	1	
• The training made me more aware of the Section 508 standards.	5	4	3	2	1	
• I learned how the requirements of a	5	4	3	2	1	

<p>telecommunication product must meet Section 508 compliance.</p> <ul style="list-style-type: none"> I learned how Section 508 compliance relates to a “self contained, closed” product. 	5	4	3	2	1
<p>Other Aspects of the Training</p> <ul style="list-style-type: none"> The multiple-choice questions reinforced ideas of the material. The real-life stories enhanced my learning of the material. Conducting the training online provides an effective learning environment. 	5	4	3	2	1
<p>Overall Rating</p> <ul style="list-style-type: none"> The training was worth taking. 	5	4	3	2	1
<p>Training Applications</p> <ul style="list-style-type: none"> I will apply what I learned in this training to my job. I would recommend this training for others in the organization. I believe the Section 508 standards will improve the design of the products for my organization. I believe the organization I work for will benefit from following the Section 508 standards. 	5	4	3	2	1
<p>Comments</p> <ul style="list-style-type: none"> How could the training be improved? 					

Appendix E

Participant Tests

Engineering Manager Test

NOTE: The correct answers are bolded and italicized.

Please select the correct answer from the listed multiple-choice options for each question:	
1. Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.	<ul style="list-style-type: none"> a. <i>True</i> b. False
2. Non-compliance of Section 508 standards can result in:	<ul style="list-style-type: none"> a. Administrative Complaint b. Civil Law Suit c. <i>Both A and B</i>
3. The term “undue burden” allows exceptions to meeting Section 508 but it requires:	<ul style="list-style-type: none"> a. Accessibility of national security systems b. <i>An alternative means for disabled individuals to access information</i> c. No documentation of the expense or difficulty to comply to Section 508
4. What are Requiring Officials responsible for?	<ul style="list-style-type: none"> a. Identify what Section 508 standard applies to the purchase b. Drafting specifications to be submitted with the purchase request c. Document any accessibility limitations of the product d. <i>All of the above</i>
5. New computers are being purchased for the software engineering group. What Section 508 requirements cover control during normal operation of the system?	<ul style="list-style-type: none"> a. Mechanically-operated controls such as the eject button on a DVD reader b. Touch-operated controls such as a touch screen c. Biometric controls such as fingerprint d. <i>All of the above</i>
6. What resources are available to assist in the procurement of computers and equipment?	<ul style="list-style-type: none"> a. GSA’s Buy Accessible Website b. VPATs c. Section508.gov Website d. <i>All of the above</i>
7. What is a VPAT?	<ul style="list-style-type: none"> a. Type of accessible device b. <i>Document created by vendors discussing how their products meet the</i>

Section 508 standards

- c. Software standard created in 1982 to assist engineers

Software Designer Test

NOTE: The correct answers are bolded and italicized.

Please select the correct answer from the listed multiple-choice options for each question:	
1.	Usability and accessibility refer to the same thing: a. True b. False
2.	The way(s) to provide information about a graphical user interface element is(are): a. Attach a redundant text label to the element b. Allow the user to attach his/her own meaning c. Provide a help file that explains how to use the element d. Include screen text that describes the element e. Answers A and D f. Answers B and C
3.	To ensure an application is accessible using only the keyboard, you should: a. Ensure every accessibility utility in every OS works with the application b. Incorporate additional code to bridge the application with the OS accessibility utilities c. If the application works well in the OS, assume that it doesn't interfere with the accessibility utilities d. Use standard OS tools and avoid implementing solutions that would interfere with the OS utilities
4.	Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies. a. True b. False
5.	A training video for the new accounting information system created for an agency does not require captions and audio description. a. True b. False
6.	Besides aiding those with hearing loss, captions also: a. Increase learning and retention by providing additional reinforcement of the material b. Facilitate the conveyance of audio content in noisy environments c. Aid in learning a second language d. All of the above
7.	Which of the following are characteristics of Assistive Technology? a. Translates input data for the OS from an alternative input device

- b. Provides alternative output such as Braille
- c. Comes in two varieties: plug-in or built-in
- d. *All of the above***

Web Technology Engineer Test

NOTE: The correct answers are bolded and italicized.

Please select the correct answer from the listed multiple-choice options for each question:	
1. A way to avoid causing the screen to flicker is to avoid using any blinking or flashing text or animation.	<ul style="list-style-type: none"> a. <i>True</i> b. False
2. A form on a website is accessible if the user can:	<ul style="list-style-type: none"> a. Access all of the information on the form b. Submit the form c. Complete all fields in the form with the appropriate information d. <i>All of the above</i>
3. All data tables on a website should have headers for the row and column.	<ul style="list-style-type: none"> a. <i>True</i> b. False
4. The standards require that color on a website be used only as:	<ul style="list-style-type: none"> a. The primary indicator of meaning b. <i>The secondary indicator of meaning after text</i> c. A pattern of similar-color combinations of yellow, blue, and green d. None of the above
5. Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.	<ul style="list-style-type: none"> a. <i>True</i> b. False
6. What steps should you take to ensure accessibility when offering a PDF document on a web page:	<ul style="list-style-type: none"> a. Offer users the option to download the PDF file b. Create an alternative HTML file c. <i>Provide a link to the Adobe Acrobat accessibility converter</i> d. Provide a link to the Adobe Web Site
7. What must you do to create applets that meet the section 508 guidelines?	<ul style="list-style-type: none"> a. Create applets that flicker at a rate of 45 Hz b. <i>Make all applets independent of the device input</i> c. Eliminate all timed responses d. Ensure that users can interact with JavaScript using a mouse

Procurement, Quality Assurance, Hardware Engineer Test

NOTE: The correct answers are bolded and italicized.

Please select the correct answer from the listed multiple-choice options for each question:
<p>1. Which of the following are requirements for telecommunications products in order to conform to Section 508?</p> <ul style="list-style-type: none"> a. Telephone controls must be designed to operate with a force greater than 5 pounds b. All products must include key repeat functionality c. <i>Controls and keys must be tactilely discernible without activating the controls or keys</i> d. All operable keys must have an auditory alternative
<p>2. A typical “self contained, closed” product would:</p> <ul style="list-style-type: none"> a. Be used without any additional peripherals b. Use embedded software c. Accept assistive technology peripherals d. Have upgradeable software e. <i>Answers A and B</i> f. Answers C and D
<p>3. The telecommunications provision of the Section 508 standards addresses which types of access:</p> <ul style="list-style-type: none"> a. Communication access b. Information Access c. Physical Access d. <i>All of the above</i>
<p>4. A “self-contained, closed” product must have a time-out period preceded by a warning and an option to request more time:</p> <ul style="list-style-type: none"> a. <i>True</i> b. False
<p>5. What is a VPAT?</p> <ul style="list-style-type: none"> a. Type of accessible device b. <i>Document created by vendors discussing how their products meet the Section 508 standards</i> c. Software standard created in 1982 to assist engineers
<p>6. Telecommunication products or systems that provide voice communications do not have to provide support for TTY users.</p> <ul style="list-style-type: none"> a. True b. <i>False</i>
<p>7. Section 508 applies to electronic and information technology developed, procured, maintained, and used by federal agencies.</p> <ul style="list-style-type: none"> a. <i>True</i> b. False

Appendix F

Participant Interview Questions

1. What other Section 508 or accessibility training or information have you received since the online courses?
2. Describe how Section 508 compliance is relevant here at work.
3. What do you think is a good approach for teaching the Section 508 standards?
4. What specific design knowledge or skills did you gain from the training (such as what is accessibility, what are the standards, who it applies to, designing accessibility features on applications, web, and multimedia technology, and how to purchase compliant equipment)?
5. Describe how eager you were to change your behavior on the job after the training.
6. Provide an example of any application of the Section 508 standards to your work.
7. List any reasons why you are not currently applying any of the standards.
8. Discuss how your awareness of accessibility issues has changed at work or outside of work.

Appendix G

Letters of Support

Letter of Support/Commitment

April 28, 2008

Mr. David M. Markham
ICS Director of Engineering and Engineering Council Chair
100 Plastics Avenue
Pittsfield, MA 01201,

Dear Mr. Markham,

I have been a General Dynamics employee for 12 years and am fortunate to have grown with the company technically and professionally through my occupation and employer-paid education. My proposed research addresses an area of improvement for General Dynamics and increases the quality and value of its products and workforce. It will satisfy the scholarly requirements of the doctoral program while fulfilling my desire to use my education and skills to improve quality of life for others through universal design.

Universal design is an approach to designing information technology products and services to be accessible for all people. Story and Mueller (2001) describe the political, economical, social, and moral benefits for practicing universal design for organizations. Some of these business incentives include cost reduction and improving the quality of life of the disabled, aging, and global population. Section 508 of the Rehabilitation Act Amendments of 1998 took effect in 2001 and provides encouragement for universal design. Section 508 does not require companies to alter their products, but rather requires products and services to meet a set of accessibility standards developed by the U.S. Architectural and Transportation Barriers Compliance Board (Access Board). The Federal Register lists the standards as 36 CFR Subsection 1194 defined by the Access Board. Any company that wishes to conduct business with the U.S. government must make products and services adhere to these standards (Architectural and Transportation Barriers Compliance Board, 2000).

My goal is to implement a computer-based training program for design engineers and managers within GDAIS to introduce universal design skills and increase accessibility awareness. At the Pittsfield site are approximately 800 software, system, and hardware engineers and managers of various ages, genders, and physical abilities. GDAIS does not provide nor require any training for its designers or engineering managers regarding Section 508. The product will serve the needs of related industries and broaden compliance with Section 508 and universal design within the federal supplier industry. Accessibility awareness will be increased within the management ranks of GDAIS to provide a mechanism by which the organization can increase its value, develop new products and services, transfer technology to other fields, and support a global market for users with different human conditions (Baquis, 2003; Shneiderman, 2002). Improving awareness is important at GDAIS, as industry perceives the U.S. government as the most important consumer of universal design products and services (The National Council on Disability, 2004).

It is imperative that I receive your support as a policy maker within the Pittsfield office of General Dynamics so that my proposed research will be approved. Upon completion of the research, I would need a formal review from your office with comments on the feasibility of implementation of training to conform to Section 508 for employees in Pittsfield. With your signature, you state that the proposed research will be of value for the organization. I thank you for your time and support on my endeavor to improve the organization through my dissertation research.

Respectfully,

Antonio R. Rincon

I Hereby Support The Proposed Research:

David M. Markham, ICS Director of Engineering and Engineering Council Chair

***Signature Removed to Protect Individual**

Signature Specimen

Letter of Support/Commitment

April 28, 2008

Mr. David M. Prenguber
ICS Engineering, Senior Manager-Software Engineering
100 Plastics Avenue
Pittsfield, MA 01201,

Dear Mr. Prenguber,

I have been a General Dynamics employee for 12 years and am fortunate to have grown with the company technically and professionally through my occupation and employer-paid education. My proposed research addresses an area of improvement for General Dynamics and increases the quality and value of its products and workforce. It will satisfy the scholarly requirements of the doctoral program while fulfilling my desire to use my education and skills to improve quality of life for others through universal design.

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Respectfully,

Antonio R. Rincon

I Hereby Support The Proposed Research:

David M. Prenguber, ICS Engineering, Senior Manager-Software Engineering

***Signature Removed to Protect Individual**

Signature Specimen

Letter of Support/Commitment

April 28, 2008

Mr. Ronald S. Mauk
Shipboard Systems, Technical Manager-Software Engineering
100 Plastics Avenue
Pittsfield, MA 01201,

Dear Mr. Mauk,

I have been a General Dynamics employee for 12 years and am fortunate to have grown with the company technically and professionally through my occupation and employer-paid education. My proposed research addresses an area of improvement for General Dynamics and increases the quality and value of its products and workforce. It will satisfy the scholarly requirements of the doctoral program while fulfilling my desire to use my education and skills to improve quality of life for others through universal design.

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Respectfully,

Antonio R. Rincon

I Hereby Support The Proposed Research:

Ronald S. Mauk, Shipboard Systems, Technical Manager-Software Engineering

***Signature Removed to Protect Individual**

Signature Specimen

Appendix H

IRB Approval Letter

NOVA SOUTHEASTERN UNIVERSITY
Office of Grants and Contracts
Institutional Review Board



MEMORANDUM

To: Antonio Rincon
From: Ling Wang, Ph.D.
Institutional Review Board
Date: March 3, 2009

Re: *Section 508 Adherence by Industry Professionals: Improving Universal Design through Training*

IRB Approval Number: wang02150902

I have reviewed the above-referenced research protocol at the center level. Based on the information provided, I have determined that this study is exempt from further IRB review. You may proceed with your study as described to the IRB. As principal investigator, you must adhere to the following requirements:

- 1) **CONSENT:** If recruitment procedures include consent forms these must be obtained in such a manner that they are clearly understood by the subjects and the process affords subjects the opportunity to ask questions, obtain detailed answers from those directly involved in the research, and have sufficient time to consider their participation after they have been provided this information. The subjects must be given a copy of the signed consent document, and a copy must be placed in a secure file separate from de-identified participant information. Record of informed consent must be retained for a minimum of three years from the conclusion of the study.
- 2) **ADVERSE REACTIONS:** The principal investigator is required to notify the IRB chair and me (954-262-5369 and 954-262-2020 respectively) of any adverse reactions or unanticipated events that may develop as a result of this study. Reactions or events may include, but are not limited to, injury, depression as a result of participation in the study, life-threatening situation, death, or loss of confidentiality/anonymity of subject. Approval may be withdrawn if the problem is serious.
- 3) **AMENDMENTS:** Any changes in the study (e.g., procedures, number or types of subjects, consent forms, investigators, etc.) must be approved by the IRB prior to implementation. Please be advised that changes in a study may require further review depending on the nature of the change. Please contact me with any questions regarding amendments or changes to your study.

The NSU IRB is in compliance with the requirements for the protection of human subjects prescribed in Part 46 of Title 45 of the Code of Federal Regulations (45 CFR 46) revised June 18, 1991.

Cc: Protocol File

Appendix I

Collected Survey Data

Survey Question	Subgroup	Survey Response Percentages				
		5 Agree	4 Somewhat Agree	3 Neutral	2 Slightly Disagree	1 Disagree
1. The goals were clearly communicated and met my satisfaction	Manager	75%	25%	0%	0%	0%
	Software	50%	42%	8%	0%	0%
	Web	29%	57%	0%	14%	0%
	Procurement	29%	43%	29%	0%	0%
2. The topics were well organized and easy to understand.	Manager	50%	25%	25%	0%	0%
	Software	67%	33%	0%	0%	0%
	Web	57%	14%	14%	14%	0%
	Procurement	36%	43%	14%	7%	0%
3. The length of the training was appropriate for the topics covered.	Manager	75%	25%	0%	0%	0%
	Software	67%	17%	8%	8%	0%
	Web	29%	29%	29%	14%	0%
	Procurement	21%	57%	14%	7%	0%
4. The level of difficulty of the content was appropriate for me.	Manager	50%	50%	0%	0%	0%
	Software	75%	25%	0%	0%	0%
	Web	57%	0%	29%	14%	0%
	Procurement	43%	50%	7%	0%	0%
5. The training made me more aware of accessibility issues.	Manager	75%	25%	0%	0%	0%
	Software	83%	8%	8%	0%	0%
	Web	71%	14%	0%	14%	0%
	Procurement	57%	36%	7%	0%	0%
6. The training made me more aware of the Section 508 standards.	Manager	75%	25%	0%	0%	0%
	Software	83%	17%	0%	0%	0%
	Web	71%	14%	14%	0%	0%
	Procurement	71%	21%	7%	0%	0%

7. I learned how to apply the Section 508 standards to our procurement process.	Manager	25%	50%	25%	0%	0%
	Software	N/A	N/A	N/A	N/A	N/A
	Web	N/A	N/A	N/A	N/A	N/A
	Procurement	N/A	N/A	N/A	N/A	N/A
8. I learned the technical requirements that computer systems must meet in order to be Section 508 compliant.	Manager	50%	50%	0%	0%	0%
	Software	N/A	N/A	N/A	N/A	N/A
	Web	N/A	N/A	N/A	N/A	N/A
	Procurement	N/A	N/A	N/A	N/A	N/A
9. I learned general design techniques for ensuring software accessibility.	Manager	N/A	N/A	N/A	N/A	N/A
	Software	50%	33%	17%	0%	0%
	Web	N/A	N/A	N/A	N/A	N/A
	Procurement	N/A	N/A	N/A	N/A	N/A
10. I learned how to add accessibility features to multimedia.	Manager	N/A	N/A	N/A	N/A	N/A
	Software	17%	50%	33%	0%	0%
	Web	N/A	N/A	N/A	N/A	N/A
	Procurement	N/A	N/A	N/A	N/A	N/A
11. I learned how to make web technology accessible.	Manager	N/A	N/A	N/A	N/A	N/A
	Software	N/A	N/A	N/A	N/A	N/A
	Web	29%	43%	14%	14%	0%
	Procurement	N/A	N/A	N/A	N/A	N/A
12. I learned how the requirements of a telecommunication product must meet Section 508 compliance.	Manager	N/A	N/A	N/A	N/A	N/A
	Software	N/A	N/A	N/A	N/A	N/A
	Web	N/A	N/A	N/A	N/A	N/A
	Procurement	57%	43%	0%	0%	0%
13. I learned how Section 508 compliance relates to a "self contained, closed" product.	Manager	N/A	N/A	N/A	N/A	N/A
	Software	N/A	N/A	N/A	N/A	N/A
	Web	N/A	N/A	N/A	N/A	N/A
	Procurement	50%	50%	0%	0%	0%

14. The multiple-choice questions reinforced ideas of the training material.	Manager	50%	25%	25%	0%	0%
	Software	42%	42%	8%	0%	8%
	Web	57%	29%	0%	0%	14%
	Procurement	29%	57%	14%	0%	0%
15. The real-life stories enhanced my learning of the material.	Manager	50%	25%	25%	0%	0%
	Software	58%	25%	17%	0%	0%
	Web	14%	57%	14%	0%	14%
	Procurement	21%	50%	21%	0%	7%
16. Conducting the training online provides an effective learning environment.	Manager	75%	25%	0%	0%	0%
	Software	33%	67%	0%	0%	0%
	Web	43%	57%	0%	0%	0%
	Procurement	50%	29%	14%	7%	0%
17. The training was worth taking.	Manager	50%	25%	25%	0%	0%
	Software	58%	33%	8%	0%	0%
	Web	29%	57%	0%	0%	14%
	Procurement	36%	29%	36%	0%	0%
18. I will apply what I learned in this training to my job.	Manager	50%	25%	25%	0%	0%
	Software	9%	36%	45%	9%	0%
	Web	14%	57%	29%	0%	0%
	Procurement	7%	14%	43%	29%	7%
19. I would recommend this training for others in the organization.	Manager	50%	50%	0%	0%	0%
	Software	25%	33%	42%	0%	0%
	Web	14%	43%	29%	0%	14%
	Procurement	14%	21%	21%	43%	0%
20. I believe the Section 508 standards will improve the design of the products for my organization.	Manager	25%	0%	75%	0%	0%
	Software	17%	50%	25%	8%	0%
	Web	29%	29%	29%	14%	0%
	Procurement	7%	7%	36%	50%	0%
21. I believe the organization I work for will benefit from	Manager	25%	0%	75%	0%	0%
	Software	17%	42%	25%	17%	0%
	Web	14%	57%	14%	14%	0%

following the Section 508 standards.	Procurement	7%	14%	36%	43%	0%
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