EXPERT INSTRUCTIONAL DESIGNERS' VIEWS OF THE IMPACT OF ACCESSIBILITY REQUIREMENTS ON E-LEARNING INSTRUCTIONAL STRATEGIES

by

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Abstract

Since 2001 e-learning created or procured by U.S. government agencies must comply with Section 508 of the Americans With Disabilities Act. Accessible e-learning provides a comparable learning experience for all learners, those with disability and without. The purpose of this study was to explore the perceptions and describe the practices of expert instructional designers in the selection of instructional strategies for accessible e-learning. A multiple case study design was used to investigate the phenomenon of instructional strategy selection for accessible e-learning. To gain the insight of experts, a purposeful sample of 10 instructional designers with at least 10 years of experience designing e-learning participated in the study. Each participant was employed by a government agency or commercial company under contract with the government to create accessible e-learning. To ensure conceptual saturation, interview and artifact data were collected, coded, and analyzed in an iterative manner to identify common patterns and themes. Study participants identified 10 instructional strategies that work for accessible e-learning and 3 that do not work. In studying factors that influence instructional strategy selection, participants consistently cited pedagogical factors such as learning objectives as having the most influence. However, there were variations in the degree of influence assigned to production factors such as budget. The majority of participants reported that they create e-learning with the goal of universal design to ensure optimal usage by all persons, including learners with disabilities. Study participants perceived that not all 508-compliant e-learning was designed in a manner that supported the needs of learners who rely on assistive technology. Participants advocated that designers be allowed to custom design e-learning specifically for learners with disabilities. Evaluating e-learning

to determine how best to support all learners, no matter what type of disability, is a topic for future research. Recommendations for the instructional design of accessible e-learning were allow pedagogical factors more opportunity to influence instructional strategy selection, identify work practices to adopt, and develop guidelines to facilitate consistent application of best practices.

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CHAPTER 1. INTRODUCTION

Introduction to the Problem

By law, e-learning created or procured by the United States federal government must be accessible to all learners, as defined by Section 508 of the Americans With Disabilities Act (Waddell, 2006). Learners with many types of disabilities typically rely on assistive technologies to access e-learning content (Pernice & Nielsen, 2001). When determining the most effective instructional strategies for e-learning, instructional designers must consider whether a strategy can be relayed through assistive technologies. This additional consideration is viewed as a problem by some and as a trade-off with few consequences by others (Buzzard, 2002; Kelly, Phipps, & Swift, 2004).

Background of the Study

The design and development of 508-compliant e-learning is a relatively recent requirement for the federal government (Waddell, 2006). In the United States, the laws and regulations that inform e-learning accessibility requirements originate from the Americans With Disabilities Act of 1990 and Section 508 of the Rehabilitation Act of 1973 (Waddell). "As software and internet capabilities grew, so did the accessibility problem for disabled users, particularly the deaf and blind" (Pulichino, 2005, p. 2).

The World Wide Web Consortium which is referred to as W3C, coordinates the development of web standards. In 1997, W3C launched the Web Accessibility Initiative

to increase awareness of the importance of web accessibility and promote the use of a framework to help organizations ensure web resources are widely accessible (Kelly et al., 2004). W3C's goal is universal design so all individuals have access to the web's digital resources (Kelly et al., 2007).

In 1998, the Rehabilitation Act was amended and signed into law, strengthening Section 508. The enforcement mechanism of Section 508 became effective June 25, 2001; from that point forward all electronic and information technology (of which e-learning is a subset) procured, used, or developed by U.S. federal government must comply with Section 508 and thereby be accessible to people with disabilities (Learning Circuits, 2009). The law and subsequent compliance standards and guidelines facilitate production and coding of accessible web resources such as e-learning, but do not address the design decisions required prior to production and coding. "Though great strides have been made during the past decade to accommodate people with disabilities (including the development of numerous assistive technologies), there is much left to be done" (Loiacono, McCoy, & Romano, 2006, p. 1).

Statement of the Problem

Guidelines for the development, that is, the production and coding of accessible e-learning, are well documented (Buzzard, 2002; Centers for Disease Control and Prevention, 2009; Pearson & Koppi, 2002; Pulichino, 2005; Virginia Information Technology Agency, 2006). Less is known, however, about the impact of accessibility requirements on the design of e-learning, specifically the selection of instructional strategies (Burgstahler, Corrigan, & McCarter, 2005; Kelly et al., 2004). Instructional

strategies facilitate learning by prescribing how content is presented to the learner and how learners interact with the content (Dick, Carey, & Carey, 2005; Jolliffe, Ritter, & Stevens, 2001).

When planning the design of e-learning and determining instructional strategies, considering content and learner characteristics is an established practice by instructional designers (Dick et al., 2005; Jolliffe et al., 2001; Morrison, Ross, & Kemp, 2004). Content characteristics to consider include the type of knowledge or content being relayed, learning and performance specified in the objective, prerequisite knowledge, and setting in which the learned content will be applied. Learner characteristics to consider include prior knowledge and attitudes toward content and work environment.

As a result of Section 508, instructional designers must consider accessibility when designing e-learning. All learners, those with disability and without, must be able to perceive, understand, navigate, and interact with the e-learning (Henry, 2006). For e-learning to be accessible, the instructional strategies selected must relay successfully through assistive technology. The degree to which the accessibility requirement impacts the selection of instructional strategies is not known. Prior to the accessibility requirement, instructional strategies were selected based on characteristics of the content and the learners (Dick et al., 2005; Jolliffe et al., 2001; Morrison et al., 2004). It is possible that the additional criterion of accessibility leads designers to select only those instructional strategies known to be accessible, rather than the optimal strategies that are based on content and learner characteristics. This potential deviation from documented instructional design practice is salient.

Purpose of the Study

The purpose of this study was to explore the perceptions and describe the practices of expert instructional designers in the selection of instructional strategies for accessible e-learning. Section 508 has been required of U.S. government agencies since 2001; instructional designers working for government agencies and commercial companies who provide instructional design services to the government are required by law to ensure e-learning complies with Section 508. These instructional designers are likely to have experience in the selection of instructional strategies for accessible e-learning. Therefore, the focus of the study was on e-learning created by the federal government or procured by the federal government from commercial companies. The study examined the process instructional designers apply when selecting instructional strategies for accessible e-learning and instructional designers' perception of the impact of accessibility requirement. The outcomes of this study include clarification of the impact Section 508 has had on instructional design practice, starting point for compilation of best practices for designing Section 508 compliant e-learning, and considerations for guidelines and policies that facilitate adoption of Section 508 compliant design practices.

Rationale

Research and literature on the instructional design aspects of accessible e-learning for self-paced learning are limited. Burgstahler et al. (2005) reported that disability related issues are rarely addressed in current published research and literature. There is considerable research addressing design and technical aspects of accessibility for online

courses in higher education settings (Adams & Morgan, 2007; Bel & Bradburn, 2008a; Burgstahler et al., 2005; Harper & DeWaters, 2008; Pearson & Koppi, 2006). For self-paced accessible e-learning, however, the focus is on technical aspects (Buzzard, 2004; Pernice & Nielsen, 2001; Mirabella, Kimani, & Catarci, 2004), rather than on design aspects.

This study focused on a specific instructional design step in the process of creating accessible self-paced e-learning: the selection of instructional strategies. By examining instructional designers' process for selecting instructional strategies and perceptions of the impact of accessibility requirement, this study provides an important first step towards the establishment of best practices and guidelines for the design of accessible e-learning.

Research Questions

The research questions for this study were set within the context of self-paced e-learning procured, used, or developed by U.S. federal government. The research questions included the following:

1. When designing accessible e-learning, what instructional strategies do instructional designers select?
2. What processes do instructional designers apply when selecting instructional strategies for accessible e-learning?
3. How do instructional designers ensure an instructional strategy will not compromise the accessibility of e-learning?
4. How do instructional designers perceive and describe the impacts of accessibility requirements on the selection of instructional strategies?

Nature of the Study

For this study a multiple case study research method was used to investigate the phenomenon of instructional strategy selection for accessible e-learning. A purposeful sample of 10 instructional designers (Creswell, 2008) was selected from multiple organizations including three federal government agencies, one state government agency and six commercial companies who create accessible e-learning for the government via contract. To ensure participants "have experienced the phenomenon being studied and share the researcher's interest in understanding nature and meanings" (Gall, Gall, & Borg, 2006, p. 496), selection of instructional designers was limited to those with significant experience of at least 10 years (Fadde, 2009) in the design of e-learning. The total number of years of instructional design experience reported by participants was 181 and the median was 15.5 years. The sampling strategy including selection criteria and selection process is described in chapter 3.

Through in-depth interviews (Trochim, 2006), the researcher explored the experiences of the instructional designers specifically as they relate to the selection of the instructional strategies for accessible e-learning. Each study participant was interviewed by phone using deep questioning in a semi-structured approach (Hatch, 2002) to investigate the process of instructional strategy selection. The questions were designed to evoke contemplation by participants to determine the influence of accessibility requirements on practice. The goal of the interviews was to collect data that provides insight on the instructional designers' decision-making processes for selecting instructional strategies for accessible e-learning.

Significance of the Study

This study made three contributions to the instructional design community. The first was it begins to clarify the impact Section 508 has on instructional design practice. Secondly, this work provided a starting point for compilation of best practices for designing Section 508 compliant e-learning. Third, it revealed considerations for guidelines and policies that facilitate adoption of Section 508 compliant design practices.

Kelly et al. (2004) asserted that a strict view of accessibility requirements limits the pedagogic purpose of e-learning within the higher education community. They encouraged academic staff to find the "balance between accessible formats and reasonable adjustment" (Kelly et al., 2004, p. 10). Buzzard (2002) implied that the impact of Section 508 is minimal in that no compromises in the richness of media or interaction are needed, but concedes there may be a need for trade-offs. To clarify the impact of Section 508 on instructional design practice, this study explored the decision-making processes and techniques used by designers to select instructional strategies.

A review of the literature revealed recurring acknowledgment of conflicting philosophies and approaches on how to approach accessibility. Some authors contend that e-learning must be designed to be usable by all. From this point of view, the term *universal design* is applied, rather than *accessibility* (M. Urban, personal communication, February 4, 2010). Others, especially outside the United States, do not use the term *accessible* at all, but rather the term *inclusive e-learning* (Bel & Bradburn, 2008b). Furthermore, there are those who approach the matter of accessibility from a social justice perspective (Pernice & Nielsen, 2001; Mirabella et al., 2004); yet, others focus only on meeting legal requirements (Waddell, 2006). This study documented the extent

instructional designers' approach and perceptions influence practice. Results can be useful for those responsible for establishing guidelines and creating policy to ensure the adoption of consistent accessible e-learning design practices.

Definition of Terms

To ensure clarity of terminology, terms referenced throughout the study are defined as follows:

Assistive technology. Assistive technology is equipment or software used by individuals with disabilities as an alternative method of performing actions, tasks, and activities. For example, screen readers are an assistive technology that enables visually impaired individuals to either hear the screen content or read content in Braille.

Accessible e-learning. Accessible e-learning is e-learning which conforms to accessibility requirements and provides all learners those with disability and without, a comparable learning experience.

E-learning. E-learning is instruction delivered through a computer by way of the Internet, intranet, compact disc, or other digital media. E-learning is designed to support specific learning objectives through a variety of instructional strategies. Types of e-learning include self-paced web-based training and instructor-led virtual training (Virginia Information Technology Agency, 2006).

Instructional strategies. Instructional strategies are the combination of techniques and methods used to relay content to learners in support of learning objectives. Some examples of instructional strategies include voice-over narration, annotated diagram, interactive animation, scenario-based exercise, and assessment activity.

Online course. Online course refers to instructor-led virtual training (Virginia Information Technology Agency, 2006) designed to be facilitated by an instructor and delivered to the learner through a course management system such as WebCT, Moodle, or ANGEL. This form of e-learning is common in higher education settings such as universities. A synonym for online course is virtual classroom.

Section 508. In the United States, the laws, regulations, and guidance that inform e-learning accessibility requirements are derived from Section 508 of the Rehabilitation Act of 1973 and the Americans With Disabilities Act of 1990 (Waddell, 2006). The Architectural and Transportation Barriers Compliance Board, commonly referred to as the Access Board, has the task of establishing and publishing the compliance standards commonly required by Section 508 (University of Washington, 2007).

Universal design. Universal design is the ideal of applying best practices and standards to ensure optimal usage of a product by all persons, including those with disabilities.

Web Accessibility Initiative. In 1997 the World Wide Web Consortium established the Web Accessibility Initiative (WAI) to improve web accessibility for individuals with disabilities and to increase awareness of the importance of web accessibility. WAI produces guidelines and technical reports clarifying accessibility requirements for web content, web browsers and media players, authoring tools, and evaluation tools.

World Wide Web Consortium. The World Wide Web Consortium, often referred to as W3C, is an international consortium established in 1994 to coordinate the development of technology standards for the web. Standards are published as W3C

recommendations with varying levels of conformance to facilitate adoption and compatibility among web-based products.

Assumptions and Limitations

One assumption of this study was that the participants, instructional designers, are experts in applying instructional design theory and principles on the basis of meeting the selection criteria. It was also assumed that the e-learning created and implemented by the participants complies with Section 508 standards. The researcher did not assess the degree to which the participants' e-learning complies with Section 508 standards. The researcher also made the assumption that the use of concept sampling would generate a suitable sample to answer the core questions for this study and reach saturation (Corbin & Strauss, 2008).

Given that Section 508 is enforced by U.S. government agencies, study participants were limited to those instructional designers employed by government agencies that create e-learning or employed by commercial companies that create accessible e-learning under contract with the government. The U.S. focus may cause readers to presume study results do not apply to non-government work settings.

Study participants were geographically dispersed and all interviews were conducted by telephone. With this method of information gathering, the researcher did not have direct visual contact with participants during interviews. This limitation, coupled with the researcher's limited experience in conducting qualitative studies, could

have hindered the researcher's ability to accurately interpret participant perceptions (Creswell, 2008). Strategies used to minimize the impact of potential limitations are reported in chapter 3.

Organization of the Remainder of the Study

The literature review, covering three overarching topics, instructional strategies, web accessibility requirements, and design and development of accessible e-learning, is presented in chapter 2. The third chapter describes the research methodology and the approach used for gathering data to address the research questions. Results of the research are reported in chapter 4 and presented for each research question. Chapter 5 provides a summary and discussion of the results, limitations, recommendations for practice, recommendations for future research, and conclusions of the study.

CHAPTER 2. LITERATURE REVIEW

The purpose of this study was to explore the perceptions and describe the practices of expert instructional designers in the selection of instructional strategies for accessible e-learning. The study was set in the domain of accessible e-learning that is self-paced and created by instructional designers for the U.S. federal government. This chapter provides a review of literature and research relevant to the study.

Topics for this review are inherent in the major elements of the study's purpose, "selection of instructional strategies" and "accessibility requirements." First, the topic of instructional strategies is addressed at a general level to explain the process and parameters instructional designers consider when selecting an instructional strategy for any context or learning environment. The second topic, web accessibility requirements, is addressed broadly to establish a basic understanding of accessibility requirements, their foundation, scope, and impact in general. The intersection of these disparate topics, that is instructional strategy selection and accessibility requirements, forms the final topic area which is the design and development of accessible e-learning. The chapter concludes with a summary that presents the highlights of each topic area, relates literature review to the research, and describes gaps in the literature.

Instructional Strategies

To examine the process that instructional designers apply when selecting instructional strategies for accessible e-learning, it is important to clarify what the term "instructional strategy" encompasses and what the literature and research reveal about the process of instructional strategy selection. This section begins with an overview of the instructional design process, which provides the foundational knowledge needed for a more in-depth look at the specific step in the theoretical process of selecting instructional strategies. To determine how the process of selecting instructional strategies for e-learning occurs in real-life contexts, the results of two studies are reviewed.

Overview of Instructional Design Process

Instructional design is a systematic process for the creation of a wide variety of instructional products (Dick et al., 2005). Instructional designers often use instructional design models such as the Dick and Carey Systems Approach Model or the ADDIE Model to create instructional materials (Dick et al., 2005). Models typically include the following five components or phases: analysis, design, development, implementation, and evaluation (Gustafson & Branch, 2002; Kirschner, 1999).

During the design phase, specifications, such as instructional strategies, are determined (Richey & Klein, 2004). Instructional strategies are concerned with how learners interact with and learn from the course features, instructional activities, and learning events (Dobrovolny, 2004; Jolliffe et al., 2001). The instructional strategies selected and designed during the design phase are not "actualized" (Richey & Klein,

2004, p. xvi) until the development phase. During the development phase, instructional strategies take shape within the product and are the "active ingredient in any learning activity" (Cook, 2005, p. 543).

Selection of Instructional Strategies

A common step during the design phase of the instructional design process is determining the best combination of instructional strategies, based on the type of content and performance specified in the objective (Morrison et al., 2004). Also referred to as "instructional methods," instructional strategies are the plans and techniques that instructional designers formulate to facilitate learning (Cook, 2005; Jonassen, Grabinger, & Harris, 1990; Morrison et al., 2004). Instructional strategies ensure students can achieve the learning goal (Khan, 2005) by prescribing how content is presented to the learner and how learners interact with the content (Dick et al., 2005; Jolliffe et al., 2001; Morrison et al., 2004).

During the design phase, when instructional strategies are determined, instructional designers must consider factors related to characteristics of the content and the learners (Dick et al., 2005; Jolliffe et al., 2001; Morrison et al., 2004). Content characteristics to consider include the type of knowledge or content being relayed, learning and performance specified in the objective, prerequisite knowledge, and setting in which the learned content will be applied. Learner characteristics to consider include prior knowledge and attitudes toward content and the work environment.

After extensive review of the literature from the higher education setting and corporate setting, there were no published studies that address instructional strategy selection within the context of accessible self-paced e-learning. Within the higher

education setting, research addressing accessibility focused on teachers' understandings and barriers in regards to accessibility for online courses (Bel & Bradburn, 2008a; Burgstahler et al., 2005; Pearson & Koppi, 2006). In addition, research in higher education focused on compliance to technical requirements for institutions' home pages and online courses (Harper & DeWaters, 2008; Petrie, Hamilton, & King, 2004). Within the corporate setting, research addressed the design of e-learning for soft skills and significant role of technology standards (Adams & Morgan, 2007).

There are two studies which offer parallels to this research study. Wood (2002) conducted a case study to explore the selection of instructional strategies for web-based learning environments. Stewart and Waight's (2008) research focused on instructional strategy selection for self-paced e-learning in a corporate or government. Each of these studies is described below.

To determine the factors that influence the selection of instructional strategies in a real-life context, Wood (2002) conducted an embedded case study with the instructors and students of an online course. The course, titled "Online Instructional Strategies" (Wood, 2002, p. 51), was a graduate level course taught completely online at a mid-western university. The course content focused on "exploring and understanding instructional strategies for web-based learning environments" (Wood, 2002, p. 15).

There were nine participants in Wood's study, two instructors and seven students. Wood considered the two instructors each as large cases and each of the seven students enrolled in the course as mini-cases. Wood's guiding research question was "What influences selections of instructional strategies for web-based instruction?" (Wood, 2002, p. 9). A review of the literature revealed eight major factors which influence the selection

of instructional strategies in the traditional classroom and distance education setting. Four of the factors, which are teaching experience, teaching content, learning needs, and teaching competencies, related to teaching and learning needs. The remaining four factors, which are support, type of technology, experience or skill, and concerns with technology, related to technology needs (Wood, 2002).

Based on Wood's findings, there are two propositions which offer "explanations for the selection of strategies for web-based instruction" (Wood, 2002, p. 49). The first proposition was that instructional strategy selection is strongly influenced by the individual's "approach to teaching" (Wood, 2002, p. 50) and "beliefs about what it means to teach" (p. 49). The second proposition relates to concerns with using innovative technology such as the online course tool to support web-based instruction.

Wood's (2002) investigation had three sources of data: surveys, interviews, and documents. The surveys were conducted with the nine participants through an online research website. The online survey inquired about the approaches that participants use to teach and participants' concerns with technology. Participants were interviewed through e-mail. The researcher reviewed documents, including the online course syllabi, discussion archives, assignment descriptions, and student assignments, specifically the web-based instructional products the students created as part of the online course.

To explore participants' approach to teaching and personal concerns with technology, Wood compared participant survey and interview responses to participant practices within the web-based instruction they created. Wood's results showed that the following factors influence instructional strategy selection: teaching conceptions,

teaching experience, type of technology, and instructor behaviors. For web-based instruction, the data indicated instructional strategy selection is more strongly influenced by the educators' beliefs for education, than by concerns about technology (Wood, 2002).

To determine the strategies and types of e-learning created for adult learners in the corporate setting, Stewart and Waight (2008) analyzed data collected through an earlier study of e-learning teams at four *Fortune* 500 companies (Waight & Stewart, 2005). The purpose of the analysis was to better understand how e-learning design teams "value their adult learners within corporate settings" (Stewart & Waight, 2008, p. 298). For the earlier study, Waight and Stewart (2005) interviewed nine individuals from four e-learning teams. The two questions guiding the cross case analysis were: "What is the nature of the e-learning solution in these companies?" and "What strategies do the e-learning teams use to value adult learners" (Stewart & Waight, 2008, p. 298).

Scholars and practitioners use a continuum of design complexity levels as shown in Table 1 to describe e-learning (Schone, 2007; Stewart & Waight, 2008). To organize their case data, Stewart and Waight (2008) classified the e-learning course designs and strategies into three levels of complexity similar to those shown in Table 1. Level 1 includes course designs with a linear structure where the learner moves from page to page. The course designs for Level 2 offer the learner more control over the sequence and presentation of content than the linear structure of Level 1. The Level 3 e-learning had the most complex designs. The performance objectives were "tied to assessments and more complex presentations through animations, simulations, case studies, video, and audio clips" (Stewart & Waight, 2008, p. 304).

The case analysis indicated that the e-learning teams "use various levels of courses which incorporated simple to complex features, and as such, required various time demands" (Stewart & Waight, 2008, p. 306) of the learners. Analysis provided evidence that the teams relied on knowledge of learning theories to determine the course complexity level and select instructional strategies. Even though the teams were not able to cite the theories, it was evident in the type of strategies employed that the teams were applying the principles of theories such as information processing theory, adult learning theory, and social learning theory (Stewart & Waight, 2008).

Table 1. E-Learning Complexity Continuum

Complexity	Description
Level 1 (low)	Linear structure where learner moves from page to page Learner has no control over sequence Content presented in static form similar to Microsoft® PowerPoint presentation and an assessment activity
Level 2 (medium)	Learner has some control over sequence and presentation of content Dynamic content presentation and concept reinforcement Learner has opportunity and flexibility to move through course in a manner suitable for the learner's specific needs.
Level 3 (high)	Complex interactions and complex presentations influenced by the learner's decisions and the choices Learner is required to interact and make decisions Real-time interaction

Note. Table created based on information in Schone, 2007 and Stewart and Waight, 2008.

Of the three levels of e-learning, all four teams created Level 1 e-learning. The cases reported that an advantage of Level 1 e-learning is the potential for rapid development. Three of the four teams reported creating Level 2 e-learning. Of the four e-learning teams, two of the teams created Level 3 courses. When deciding on course level, factors considered were availability of time, technology, and human resources (Stewart & Waight, 2008).

The studies conducted by Wood (2002) and Stewart and Waight (2008) exemplify how selection of instructional strategies differs depending upon the learning environment. In the academic setting, factors associated with instructional strategy selection are more strongly influenced by the educators' beliefs for education, than by concerns about technology (Wood, 2002). While in the corporate setting, instructional strategy selection is influenced by availability of time, technology, and human resources (Stewart & Waight, 2008).

Web Accessibility Requirements

Web accessibility means that everyone, those with and without disabilities, has equal access to information and functionality of web pages, thereby ensuring the individual's ability to "perceive, understand, navigate, and interact with the Web" (Henry, 2006, p. 2). To understand the potential impact web accessibility requirements have on instructional strategy selection for e-learning, one must first have a basic understanding of web accessibility, its origins, scope, and legal aspects. It is important to understand accessibility in terms of the disabilities addressed and the assistive technology used by disabled individuals to access web content.

To provide essential information about web accessibility requirements, this section addresses the following facets of accessibility: web standards, approaches to accessibility, legal requirements, and an overview of disabilities and assistive technology. The section concludes with a summary of relevant studies addressing the impact accessibility requirements have had on the design and production of general websites.

Web Standards

The World Wide Web Consortium is an international consortium founded in 1994 that serves as a vendor-neutral forum with over 400 members committed to leading the web to its full potential through the creation of web standards (Brewer & Participants of the Education and Outreach Working Group, 2005). To promote and support a high degree of usability for people with disabilities, the World Wide Web Consortium established the Web Accessibility Initiative, or WAI (W3C, 2010). Through the WAI, the Consortium works with organizations around the world to develop strategies, guidelines, and resources to help make the web accessible to people with disabilities (W3C, 2010).

The World Wide Web Consortium released the first formal guidelines for identifying how to develop accessible web content in 1999 titled the "Web Content Accessibility Guidelines" or WCAG (W3C, 2008). The initial release of WCAG marked the "first time there was an international standard for web accessibility, developed and supported by consensus among representatives" (Brewer, 2004, p. 52) of key stakeholders. Developers of content, authoring tools, and accessibility evaluation tools follow the guidelines set forth in WCAG 1.0 to determine the level of accessibility and to ensure products are as accessible as possible (Brewer, 2004; W3C, 2008; WebAIM, 2009b).

The first version of the guidelines, WCAG 1.0, consists of 14 guidelines and a list of checkpoints for each guideline (University of Washington, 2007). In total, there are 65 checkpoints. Each checkpoint has been assigned a priority level of 1, 2 or 3. Priority 1 checkpoints are the most critical; these address barriers that make it impossible for all users to assess the content. The checkpoints designated as Priority 2 address barriers that make access difficult for all users. While the checkpoints designated as Priority 3 address barriers that make access somewhat difficult for all users (University of Washington, 2007).

To produce guidelines and recommendations such as WCAG, the World Wide Web Consortium has adopted a consensus process to encourage and ensure broad community input (Brewer, 2004; W3C, 2006). Since the release of WCAG 1.0, the Consortium has received extensive feedback from Consortium members and from the community of stakeholders including accessibility experts and members of the disability community. Comments specifically noted that WCAG 1.0 did not address advances in web technologies and advances in assistive technology (Brewer, 2004; WebAIM, 2009b).

In December 2008, the World Wide Web Consortium released WCAG 2.0, which was based on WCAG 1.0, but introduced significant changes in terms of the philosophical basis (WebAIM, 2009b). WCAG 2.0 applies broadly to more advanced technologies and is easier to use and understand (W3C, 2008). The new guidelines are principle-centered rather than technique-centered, thus allowing the guidelines to be technology-neutral and relevant even as technology advances (WebAIM, 2009b). The

four principles are perceivable, operable, understandable, and robust; each must be addressed in order for web content to have a high degree of usability for all individuals (W3C, 2008).

In lieu of specific checkpoints, WCAG 2.0 "tell[s] you what to do, not how to do it" (Urban & Burks, 2006, p. 462) through guidelines and three levels of success criteria. For example, to address the issue of text size, WCAG 1.0 provides the following specific technical instructions: "Use relative rather than absolute units in markup language attribute values and style sheet property values" (W3C, 1999, "Guideline 3," para 4). While the guideline offered with WCAG 2.0 provides the following goal: "Except for captions and images of text, text can be resized without assistive technology up to 200 percent without loss of content or functionality" (W3C, 2008).

Through its standards and guidelines, the World Wide Web Consortium strives to promote and support the highest degree of usability for people with disabilities. The Consortium contends that applying either version of WCAG results in web content with a high degree of accessibility; the content is accessible to a wider range of people with disabilities, including visual, auditory, cognitive, physical, speech, and combinations of these (WebAIM, 2009a). The Consortium also claims that following the newer guidelines, WCAG 2.0, results in web content that is more usable to the general public (W3C, 2008). Brewer (2004), however, warned that one should not assume that all that is needed to create accessible content is to simply follow and implement the Consortium's guidelines. Henry (2006) stated "WCAG should be the guiding force in accessibility efforts"; she cautions that the "goal of accessibility is not to check off a guidelines list; the goal is to make your site accessible" (p. 29).

Approaches to Accessibility

There are varying perspectives and approaches one can take when making web content, such as e-learning, accessible. As Tim Berners-Lee, the inventor of the web and the Director of the World Wide Web Consortium, stated, "The power of the web is in its universality. Access by everyone regardless of disability is an essential aspect" (W3C, 2010, para. 1). Universality, universal design, and usability refer to the use of best practices in interface design and application of standards to ensure maximum usage and effectiveness for everyone, regardless of specific traits such as disabilities (M. Urban, personal communication, February 4, 2010).

As opposed to universality, Kelly et al. (2004) propose a pluralistic or holistic approach to accessibility for e-learning. Within e-learning, universal design focuses on the accessibility of the e-learning product while a holistic approach extends the focus to include accessibility of the learning outcomes (Kelly et al., 2004). Adopting this holistic approach could present challenges to the web developer who traditionally focuses on required guidelines such as WCAG. With the holistic approach, the developer expands the focus to also consider contextual aspects including usability, pedagogical issues, available resources, and organization culture (Kelly et al., 2004)

To determine the accessibility approach applied at a higher education institution, Bel and Bradburn (2008a) conducted a survey via paper and online with the 70 “HE [higher education] teaching staff” (p. 3). Each survey was followed by an interview to determine what support the teachers need to develop inclusive online learning experience. The results showed that teachers are not implementing pedagogically sound lesson designs because the teachers are concerned that the designs are not compliant with

standards. Teachers need guidance that will help them move beyond focusing primarily on adhering to web standards and toward adopting a pedagogical perspective of accessibility (Bel & Bradburn, 2008a).

When creating online learning, the teachers should first devise a curriculum design plan driven by pedagogical aspects rather than technical requirements (Bel & Bradburn, 2008b). Technical aspects such as adhering to accessibility requirements should be considered only within the confines of the plan. To fully meet the accessibility goal, Bel and Bradburn (2008b) advocate the adoption of an inclusive learning approach in which no one is discriminated against in terms of educational strategies. The focus needs to move beyond web guidelines and toward a pedagogical perspective of accessibility (Bel & Bradburn, 2008a).

Accessibility best practices should be supported fully because it is the "right thing to do" (Mirabella et al., 2004, p. 3). "As long as companies and government agencies view accessibility solely as a matter of complying with regulations and technical specifications, rather than a way to support the work practices and customer needs of people with disabilities, equal opportunity will remain a travesty" (Pernice & Nielsen, 2001). Accessibility best practices go beyond applying the required compliance standards during the production and coding. In addition to meeting required compliance standards, accessible e-learning should be designed to ensure all learners can accomplish the learning goals set for the e-learning.

Legal Requirements

Around the world the rights and needs of students with disabilities are recognized through a growing body of national laws and policies addressing accessibility of the information and communication technologies (Pearson & Koppi, 2002). Countries such as Canada, Japan, Australia, and the United Kingdom are at the forefront with efforts towards electronic accessibility (Buzzard, 2004). A commonality among countries is the use of WCAG as a basis for laws and policies (W3C, 2006). But each country's approach to accessibility varies. Some view accessibility as a human or civil right, and therefore, the policies and laws apply to all. Others limit the scope of policies and laws to the information and communication technologies purchased or created by the government (W3C, 2006).

In the United States, the laws, regulations, and guidance that inform e-learning accessibility requirements stem from the Americans With Disabilities Act of 1990 and Section 508 of the Rehabilitation Act of 1973 (Waddell, 2006). As of June 25, 2001, all electronic and information technology created or procured by the U.S. government must be accessible to all users as defined by Section 508 of the Americans With Disabilities Act (Waddell, 2006). E-learning is an example of electronic and information technology to which Section 508 applies. Therefore, by law, e-learning must be in compliance with Section 508 Technical Standards 36 CFR Part 1194. Instructional designers who create e-learning for the U.S. federal government must be knowledgeable of current Section 508 standards in order to apply the standards and ensure e-learning complies with the law.

The Architectural and Transportation Barriers Compliance Board which is referred to as the Access Board, has the task of establishing and publishing the compliance standards required by Section 508 (University of Washington, 2007). The Access Board standards are commonly referred to as the 508 standards. The 508 standards closely parallel the World Wide Web Consortium's guidelines, WCAG 1.0. There are two 508 standards that are more restrictive than WCAG, and those are the standards pertaining to skip navigation and screen flicker. There is only one 508 standard not addressed by WCAG, and that is the issue of timed response. Per the 508 standards when using a timed response, the end-user should be alerted and provided enough time to request more time if needed (Thatcher, 2007).

While the Consortium's guidelines have an aim of universal design, the Section 508 standards define the minimum level of web accessibility. In general, the Consortium's guidelines represent a higher level of accessibility than Section 508 standards (United States Access Board, n.d.). Therefore, if a website conforms to WCAG, the website will be compliant with Section 508 standards, with the one noted exception above of the 508 screen flicker standard.

Revisions to the 508 standards are underway to clarify the requirements, focus on functions, and harmonize with other guidelines and standards such as WCAG 2.0 (United States Access Board, 2010). The updated standards have been organized into a single draft document titled "Information and Communication Technology (ICT) Standards and Guidelines" (United States Access Board, 2010). The Access Board (2010) released the updated guidelines for comment through June 2010.

Overview of Disabilities and Assistive Technologies

While an instructional designer can design accessible e-learning without a deep understanding of what the terms disability and assistive technology encompass, it is helpful to know some basic facts about these concepts. In this section, the types of disabilities, magnitude of disabilities, and various types of assistive technology are reviewed.

In June 2001, President Bush addressed the new procurement law stating that because of Section 508, government websites will be more accessible for millions of Americans who have disabilities" (Bush as cited in Waddell, 2006, p. 534). Among working age Americans, that is age 18 to 64, there are over 18.9 million who have at least one disability that could potentially interfere with e-learning (U.S. Census Bureau, 2008b).

According to the 2008 American Community Survey, 36 million Americans of all ages have at least one type of disability (U.S. Census Bureau, 2008b). Table 2 lists the four types of disabilities and the number imputed for each type. The number of disabilities is roughly the same for all four types with the largest percentage imputed for ambulatory (4.61 %) and the smallest percentage for hearing (3.9%).

Each of the four disability types includes specific impairments. Ambulatory disabilities include physical, speech, and motor impairments. Cognitive disabilities encompass impairments with dyslexia, attention deficit disorder, mental health disabilities, and seizure disorders. Visual disabilities include blindness, low vision, and color blindness. Hearing disabilities includes degrees of deafness.

Table 2. Imputation of Disabilities by Type

Type of disability	Estimated number of Americans with one or more disabilities
Ambulatory	12,792,170 (4.61%)[a]
Cognitive	12,529,250 (4.51%)[a]
Visual	12,486,663 (4.18%)[b]
Hearing	11,652,842 (3.9%)[b]

Note. Adapted from "Number of Americans With a Disability Reaches 54.4 Million," by U.S. Census Bureau, 2008b, Retrieved from http://www.census.gov.

A common accessibility myth is that people with disabilities only need to acquire the right special assistive technology to support their disability in order to replace the inaccessible information on websites (Brewer, 2004). According to the Technology-Related Assistance for Individuals With Disabilities Act of 1988, assistive technology is "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities" (Scherer, 2005, p. 36). Assistive technology provides disabled individuals alternate ways to perform actions, tasks, and activities (Kintsch & DePaula, 2002).

In the United States, there are over 13 million people who use assistive technology devices (Kintsch & DePaula, 2002). Each piece of federal legislation passed since 1988 regarding persons with disabilities mandates the consideration of assistive technology (Scherer, 2005). Called "assistive devices" or "assistive technologies," the devices listed in Table 3 are an important part of the education and rehabilitation of

people with disabilities. The type or combination of assistive technology used by individuals depends upon the disability and preferences. Table 3 lists the primary assistive technology used by individuals for each major disability type. The types of disability are listed in ranking order based on the percentage of occurrence in the American population.

Table 3. Assistive Technology for Disabilities by Type

Type of disability	Example of assistive technology
Ambulatory	Alternative pointing devices and switches One-handed keyboards
Cognitive	None. Access is addressed through design considerations only.
Visual	Screen readers Screen magnifiers for low vision
Hearing	Audio amplifiers Telecommunications devices for the deaf

Note. Adapted from "Beyond ALT Text: Making the Web Easy to Use for Users with Disabilities," by K. Pernice and J. Nielsen, 2001, Retrieved from http://www.nngroup.com/reports/accessibility/beyond_ALT_text.pdf and from "Survey of Preference of Screen Reader Users," by WebAIM, 2009a, Retrieved from http://webaim.org.

In Table 3 no assistive technology is noted specifically to support individuals with cognitive disabilities. The list of cognitive disabilities is broad and ill-defined, but includes categories such as deficits or difficulties with memory, reading, and comprehension. Web developers rely on usability and design best practices to address the needs of individuals with cognitive disabilities (WebAIM, 2009a).

In terms of assistive technology, the focus of web developers has been on ensuring the content is accessible through screen readers for the visually impaired (Miyashita, Sato, Takagi, & Asakawa, 2007; WebAIM, 2009a). Little focus has been placed on the needs of others in the disabled community, specifically the hearing impaired (WebAIM, 2009a). It was assumed that the web was primarily a visual medium therefore visually impaired individuals would have the most trouble accessing content (WebAIM, 2009a).

For each type of disability there are accessible design solutions to apply (see Table 4). From a purely technical standpoint, it is impossible to design a single version of web content that is equally understandable across the full spectrum of disabilities and through all variations of assistive technology (WebAIM, 2009a). Given the diverse abilities, preferences, and assistive technologies of individuals, the optimal approach for web design is "following accessibility guidance and standards, using technologies that support high levels of accessibility, and provides users with options" (WebAIM, 2009a, p. 20).

Impact of Accessibility Requirements on Websites

Of interest for this study are the literature and research addressing issues encountered in the design of general websites that may also occur in the design of e-learning. There may be similarities between the impact of accessibility requirements on the design of general websites and on the design of e-learning. A reoccurring theme in the literature regarding the impact of accessibility requirements on the general website design is the conflict with visual design (Harper & DeWaters, 2008; Petrie et al., 2004; Regan, 2004). Three studies examined the relationship between accessibility and visual design.

Table 4. Accessible Designs for Disabilities by Type

Type of disability	Accessible design solutions
Ambulatory	Keyboard equivalents for mouse-driven commands; Keyboard or single-switch support; and Alternatives for speech input on voice portals
Cognitive	Use of supplemental graphics; Freezing animated graphics; Multiple search options; Clear and simple language; Consistent design and navigation options; Appropriate language level; and No flickering or strobing designs.
Visual	User control of style sheets; Appropriate markup of tables, abbreviations, and acronyms; Alternative text describing media elements; Keyboard support; Synchronization of visual, speech, and Braille display; Magnification; Stopping scrolling text; and Avoid pop-up windows
Hearing	Captioned audio portions of multimedia files and user control of style sheets

Note. Adapted from "Beyond ALT Text: Making the Web Easy to Use for Users with Disabilities," by K. Pernice and J. Nielsen, 2001, Retrieved from http://www.nngroup.com/reports/accessibility/beyond_ALT_text.pdf and from "Survey of Preference of Screen Reader Users," by WebAIM, 2009a, Retrieved from http://webaim.org.

Petrie et al. (2004) designed a study to dispel the belief that accessible sites cannot be visually appealing. Some web developers believe that in order for a site to be accessible to users with disabilities, the site must be "uninteresting and simple, particularly visually uninteresting—plain, vanilla sites" (Petrie et al., p. 13). To determine if accessibility requirements constrain visual design and thereby negatively impact aesthetic appeal, Petrie et al. designed a two-part study to evaluate a cross-section of 1,000 websites. In the first part of the study, accessibility was evaluated for 1,000 websites using the accessible module of WebXM as the testing tool. For the second part of the study, a representative sample of 100 of the websites were selected for manual checking by a user panel consisting of 51 disabled users representing a variety of

disabilities. The user panel included 31 visual impaired, 11 auditory impaired, and 9 physical impaired volunteers. The cross-section of websites was selected from the following five sectors: government, public info, business, e-commerce, entertainment, and leisure and web services such as search engines. For both parts of the study the websites were evaluated against the WCAG 1.0 guidelines.

Each user evaluated 10 sites and was assigned two context appropriate tasks. For example, for a banking website the task was to find current interest rates for a specific type of account. Results showed that the blind participants only completed 53% of the assigned tasks. The average task completion rate for all the other participants was 82%. Common problems encountered by all participants included cluttered and complex page layout, poor navigation design, poor contrast between content and background, incompatibility with assistive technology, and small text and graphics.

Of the 100 websites evaluated, three websites scored high on accessibility and complex visual designs. These exemplar websites show that it is possible to "achieve complex and even pleasing visual design without seriously compromising practical accessibility and usability" (Petrie et al., 2004, p. 18). Tension only exists between accessibility and visual design when website success is based on creative freedom rather than on "maximizing the user's experiences and meeting business objectives" (Petrie et al., 2004, p. 18). They asserted that accessibility does not constrain visual design; it is just one of the challenges web developers face "along with creating a site that is usable, interesting and appealing to mainstream users" (Petrie et al., 2004, p.13).

Harper and DeWaters (2008) conducted a case study with 12 voluntary higher education institutions. Higher education institutions that offer online learning environments have the responsibility and civic obligation to provide equal access and participation for all possible learners (Harper & DeWaters, 2008). The research goal was to determine how higher education websites could incorporate Universal Design of Learning principles into practice to improve website accessibility.

To gauge the level of accessibility, Harper and DeWaters (2008) used Watchfire® eBobby™, an accessibility testing tool, with each institution's home page. The tool tested the webpage for adherence to WCAG 1.0 guidelines. Of the 12 participating institutions, four (33%) did not comply with any of the WCAG checkpoints. Only 1 (8%) institution complied with all the WCAG checkpoints and had a highly accessible website.

To learn more about how the one institution approached accessibility successfully, Harper and DeWaters (2008) conducted an informal survey with the exemplary institution. Insights gathered from the survey indicate that success hinges upon having a serious commitment to accessibility. Through comprehensive planning, practical goals, and collaboration, the institution secured and maintained the resources needed, including personnel solely focused on accessibility.

The participants in the study indicated problems with meeting the diverse demands of stakeholders such as admissions, professors, students, and personnel. The websites must support the functionality requirements of all the stakeholders and maintain aesthetic appeal while also complying with accessibility standards. The key result of the

study was that web accessibility is not yet seen as a priority among majority of the respondents. The challenge to the institutions is maintaining a balance between aesthetic appeal and compliance.

Regan (2004) stated that "accessibility is often viewed as a limitation on creativity and design" (p. 29). To gauge the current standing of accessibility versus design, Regan (2004) reviewed the 41 websites listed as winners of a Webby Award. While only five of the websites reviewed met the WCAG 1.0 guidelines, it is worth noting that more than half of the websites met most of the guidelines. These findings support Regan's contention that accessible sites do not have to be boring; he attributed the current inadequate state of accessibility to a "failure of imagination" (2004, p. 30). A long-term solution recommended is sustained and ongoing training "to develop better instincts for the non-visual and keyboard driven UI [user interface]" (Regan, 2004, p. 37).

Of note, when Regan (2004) conducted the study of the Webby Award winners, accessibility was not included as judging criteria. For the 2010 Webby Awards, the judging criteria included the following criteria for functionality: "The most functional sites also take into consideration those with special access needs. Good functionality makes the experience center stage and the technology invisible" (Webby Awards, n.d.).

Design of Accessible E-Learning

This study focused on how the selection of instructional strategies is impacted by the accessibility requirements that apply to electronic and information technology (EIT). The specific type of EIT of interest in this study was self-paced e-learning. Earlier in this chapter the selection of instructional strategies was reviewed with some specifics in the

area of e-learning. Separately, the topic of web accessibility requirements was reviewed. The final topic to review in this chapter centers on the process surrounding the selection of instructional strategies for e-learning specifically when accessibility is a goal.

This section begins with clarification of the terms *e-learning* and *accessible e-learning*, as imposed by the context of this study. Findings of relevant research are reviewed and benefits of accessibility for e-learning are noted.

Overview of E-Learning

To examine the selection of instructional strategies for e-learning, it is important to clarify what is meant by the term "e-learning". When broadly defined, e-learning refers to instruction delivered through a computer. Clark and Mayer (2003) defined e-learning as follows:

> Instruction delivered on a computer by way of CD-ROM, Internet, or intranet with the following features: includes content relevant to the learning objectives, uses instructional methods such as examples and practice to help learning, uses media elements such as words and pictures to deliver the content and methods and builds new knowledge and skills linked to individual learning goals or to improved organizational performance. (p. 13)

Clark and Mayer's (2003) definition of e-learning encompassed a range of e-learning types, including self-paced e-learning and instructor-dependent e-learning. For this study, the focus was self-paced e-learning, that this researcher characterizes as training delivered via a computer and is designed to increase the knowledge and skills of workers in commercial and government settings.

Many scholars and practitioners describe e-learning in terms of a continuum of complexity levels for the design or interactions as shown in Table 1. Stewart and Waight (2008) used a similar three-level continuum to classify e-learning course designs and

strategies in their study. Carliner (2008) referred to the most basic level as the bronze level. This basic type of e-learning communicates information with no performance expectations (Kuhlmann, 2008) and with minimal interaction required of the learner (Schone, 2007). The main interaction for the learner is advancing to the next screen. The next level on Carliner's continuum is the silver level. The learner has some control over the sequence and presentation of the instruction but interaction is still limited. Step by step instructions are provided targeting specific measurable outcomes. The highest level for Carliner (2008) is the gold level. Complex interactions and decision making are required of the learner in order to advance through the e-learning.

Adams and Morgan (2007) asserted that self-paced e-learning addressing technical skills has revolutionized the workplace by providing critical training "instantaneously across time and geographical boundaries" (p. 157). They do not see the same success with e-learning addressing soft skills, specifically leadership skills. The pedagogical approach proven to be successful for e-learning addressing technical skills is not as effective with e-learning addressing soft skills (Adams & Morgan, 2007). An e-learning industry trend noted by Adams and Morgan (2007) is how technology standards are driving the design of e-learning rather than the intended purpose of the e-learning.

Through a six year, action-oriented research project, Adams and Morgan (2007) created a decentralized e-learning development system to produce e-learning addressing leadership skills. The system was pilot tested in a variety of educational and corporate settings. Findings indicated that the emphasis on technical standards required by learning management systems such as SCORM (Shareable Content Object Reference Model)

resulted in a trade-off between creating effective e-learning and compliant e-learning. The research findings supported the importance of taking a pedagogical rather than a technology driven approach.

Accessible E-Learning

E-learning is an example of electronic and information technology (EIT), to which the accessibility requirements based on Section 508 of the Americans With Disabilities Act apply. Accessible e-learning is "electronically generated instruction that is equally accessible and useable to those whose sensory, movement and cognitive limitations interfere with the use of a computer" (Pulichino, 2005. p. 2). Buzzard (2002) defined accessible e-learning as e-learning that is "equal access, equal use and equal effectiveness" (p. 2).

The World Wide Web Consortium recognizes that, in practice, not all web content will reach full accessibility. There are varying degrees or levels of accessibility that web content, such as e-learning, can attain. To provide all learners, those with and without disabilities, comparable learning experiences, there are three possible degrees of accessible e-learning: universal design (Degree 1), accessibility (Degree 2), and accommodation (Degree 3) (M. Urban, personal communication, February 4, 2010).

Accessible e-learning classified as Degree 1 incorporates best practices of universal design to ensure maximum usage by all learners, those with disabilities and those without. As with inclusive design (Bel & Bradburn, 2008b), universal design requires planning to ensure the e-learning is designed to meet the needs of all people regardless of culture, age or disability. Some best practices for universal design include the following: the e-learning includes an option for instant translation of content to other

languages, the e-learning includes the option of scalable fonts so learners can select the preferred text magnification, and the e-learning does not rely on color alone to emphasize key information (M. Urban, personal communication, February 4, 2010).

Accessible e-learning classified as Degree 2, incorporates best practices of accessibility specifically to enhance the learning experience for learners using assistive technology. The enhancements for this degree of accessibility only impact learners using assistive technology. Standard accessible design best practices include the inclusion of descriptive alternative tags for all images, ensuring e-learning can be navigated with a keyboard only, and use of underlining is avoided.

In some cases it is impossible to design e-learning employing the principles of universal design. There might also be situations, although rare, when it is impossible to design e-learning that is accessible through assistive technology. Whether the inaccessibility is due to a technological, disability-related, or user factor, the choice at that point is accommodation, the third degree of e-learning accessibility (M. Urban, personal communication, February 4, 2010).

Accommodation involves bringing the content to a learner in an unobtrusive manner to avoid singling out the individual. To determine how best to accommodate the specific needs of a learner, one must first understand the learner's situation, such as the assistive technology available, type of disability or combination of disabilities, and what specific content the learner finds inaccessible. If portions of the content are not accessible for a learner using the assistive technology available, one option to accommodate the

learner is to provide the content in a form supported by the specific assistive technology available to the learner. For example, if a learner's screen reader is incompatible, the screen content could be relayed via telephone or streaming media.

Research Related to Accessible E-Learning

The majority of the research in the area of accessibility and electronic and information technology focuses on instructor-dependent e-learning, rather than self-paced e-learning. The studies which address accessible design issues of instructor-dependent e-learning take place in formal education settings such as universities and colleges (Bel & Bradburn, 2008a; Burgstahler et al., 2005; Harper & DeWaters, 2008; Pearson & Koppi, 2006; Robinson, 2006). There were no studies which addressed accessible design issues of e-learning in a corporate or government setting.

Bel and Bradburn (2008a) conducted a study focused on the "pedagogical perspectives" (p. 1) that teachers in higher education adopt when developing accessible online learning experiences. The survey tool was administered to higher education teachers located in six schools within a single university to measure current accessibility practices. There were 70 respondents. The survey was followed up with interviews to establish the support needs of the respondents for developing inclusive learning experiences. Survey results indicated problems the teachers have in implementing WCAG guidelines, including the lack of planning for inclusive learning experiences at the design stage and the need for further staff support.

Bel and Bradburn (2008a) concluded that in order for higher education teachers to respond effectively to the diverse needs of learners, they need to move beyond focusing solely on applying web standards. Higher education institutions should adopt a model

that helps teachers “reframe their conceptions of accessibility into a pedagogical perspective which emphasizes design of an inclusive curriculum” (Bel & Bradburn, 2008a, p. 5). They propose a solid pedagogical framework emphasizing the role of teaching not just as a facilitator of learning.

In higher education settings, academic staff have encountered barriers to adopting accessible design practices (Pearson and Koppi, 2006). Staff development activities have focused on the technical skills needed to create accessible resources. Over a five year period, Pearson and Koppi (2006) have “researched, developed, and refined” (p. 2) their approach to encourage academic staff to adopt inclusive design practice (i.e., universal design). Data were collected through an online discussion forum, e-mail questionnaire, and workshop feedback.

Based on analysis of study data, Pearson and Koppi (2006) delineate three stages of academic support: Motivating staff by encouraging empathy with student with disabilities, training to develop basic skills in accessible designs using the tools staff are familiar with, and institutional planning to ensure awareness training and access to expert support and resources. Staff development activities should be designed to motivate academics by convincing them that inclusive practice means improving the learning experience for all students.

Robinson (2006) conducted a Delphi study focused on the needs of a specific learner population, visually impaired children in the K-12 educational setting. The goal of the study was to identify learning strategies that increase and improve access to education and instruction by visually impaired children. Study results include a collection of learning strategies for the visually impaired. The list of learning strategies can serve as a

reference for learners to use to improve their access to education and instruction. The list can also be used to encourage and inform education professionals in the use of online learning as an educational tool for the visual impaired learners.

The eLearning Guild is a professional organization with over 37,000 members including instructional designers (eLearning Guild, n.d.). To determine the level of knowledge organizations have regarding accessible e-learning, the eLearning Guild conducted a survey. The survey was open to Guild members and eLearning Guild website visitors. At the time of the survey, there were approximately 15,000 Guild members. All of the members were invited via e-mail to participate in the survey which was available on the Guild's website. Of the respondents, 31% reported their role as instructional designer and 54% reported having limited knowledge regarding Section 508 standards (Pulichino, 2005).

Buzzard (2002) was faced with the challenge of creating a fully accessible e-learning course. Buzzard's definition of fully accessible is similar to universal design. As an initial step, Buzzard conducted an exhaustive search for a "comprehensive authoring tool that could generate all the required accessibility features needed for learners" (p. 3) with disabilities. The search of commercially available tools yielded no authoring system that could be used to produce accessible e-learning easily. Therefore, Buzzard's team adapted authoring tools and developed specific guidelines they then used to design the accessible e-learning course. Buzzard reported that no compromises were needed in terms of the richness of media and interactions employed. Buzzard did encounter trade-offs. Specifically, it was not feasible to make visual identification exercises such as click and drag or matching accessible. Based on this initial experience

designing accessible e-learning, Buzzard recommends using simple course designs; no bells and whistles; all screen elements must have an educational function and be usable by all.

Benefits of Accessibility

Adopting accessibility best practices results in web designs that benefit and appeal to all users, not just those who are disabled (Brewer, 2004; Burgstahler et al., 2005; Mirabella et al., 2004). Additional benefits for adopting accessibility best practices are that "it has the potential to create a market opportunity . . . and it involves innovative technology" (Mirabella et al, 2004, p. 19).

Accessible designs increase the usability of websites in different situations, such as those settings with low bandwidth, noisy environment, or screen-glare (Brewer et al., 2005). The redundant text, audio and video can support individuals with different learning styles, low literacy levels, or second-language access. Accessibility also results in more efficient webpage transmission and website maintenance. When audio files are captioned, the indexing of content improves, thereby resulting in faster searching of content (Brewer et al., 2005).

Summary

This summary includes highlights of the three major topic areas, instructional strategies, web accessibility requirements, and design of accessible e-learning. Gaps in the literature are noted. Connections between the literature reviewed and this research study are outlined.

Literature Review Highlights

The literature reviewed for the instructional strategies topic included reference textbooks for instructional design theory. These texts maintain that during the design phase instructional designers should consider characteristics of the content and the learners when selecting instructional strategies (Dick et al., 2005; Joliffe et al., 2001; Morrison et al., 2004). Instructional strategy research revealed that instructional designers and educators consider additional factors when selecting instructional strategies. Within the practice setting of online learning course design, Wood (2002) documented that the factors having the most influence on instructional strategy selection are the pedagogical-oriented factors of the educator's conceptions and beliefs for education rather than the educators' concerns about technology (p. 189). While in the learning environment within a corporate setting, e-learning design teams are most influenced by the production-oriented factors of time, technology, and human resources (Stewart & Waight, 2008). In practice, the selection of instructional strategies is influenced by practical factors specific to the learning environment (Stewart & Waight, 2008; Wood, 2002).

The literature reviewed for the web accessibility requirements topic focused on the WCAG and Section 508 standards and how those standards are applied in the practice setting of general website design. The World Wide Web Consortium shapes how web accessibility is achieved through the publication of web standards and guidelines. Web developers follow the Consortium guidelines to create accessible web content, that is, web content which can be accessed by all users, disabled and nondisabled alike, also referred to as "universality" or "universal design." Across the globe, there are varying

approaches and viewpoints on accessibility from universal design (M. Urban, personal communication, February 4, 2010) to holistic approach (Kelly et al., 2004) to strictly adhering to the applicable laws.

Web developers creating web content for the U.S. federal government, must adhere to Section 508 standards to comply with the law. Section 508 standards define the minimum level of web accessibility. WCAG, the Consortium's guidelines, define the maximum level of web accessibility, which is referred to as universal design. If a website conforms to WCAG, the website will be compliant with Section 508 standards with the one noted exception of the 508 screen flicker standard.

The conclusion of three studies dispel the misconception that accessible sites cannot be visually appealing (Petrie et al., 2004; Regan, 2004; Harper and DeWaters, 2008). Web developers who intend to create accessible web content must adhere to at least a subset of the web standards and guidelines discussed in this section. While maintaining the balance between accessibility and aesthetics is a challenge, complex visual designs can be achieved without compromising practical accessibility and usability (Petrie et al., 2004). To achieve and maintain this balance, an organization must have a serious commitment to accessibility and adopt a comprehensive plan focused on "maximizing the user's experiences and meeting business objectives" (Petrie et al., 2004, p 18).

The literature and research reviewed for the topic of accessible e-learning highlights key findings that will influence this research study. One such finding is the distinction between degrees of accessibility and the growing emphasis on the highest degree of accessibility, universal design, rather than technical standards. The design and

development of accessible e-learning "involves incorporating principals of universal design, accessibility, and (where necessary) accommodation to provide students with and without disabilities a comparable learning experience" (M. Urban, personal communication, February 4, 2010).

Gaps in the Literature

There is research focused on instructional strategy selection and other pedagogical aspects of accessible instructor-dependent e-learning in academic settings (Bel & Bradburn, 2008a; Burgstahler et al., 2005; Harper & DeWaters, 2008; Pearson & Koppi, 2006; Robinson, 2006). However, a gap noted in the literature is the lack of research on instructional strategy selection for accessible self-paced e-learning. One speculation as to why there is a shortage of published research in this area is the need for corporations to classify research findings as proprietary information and therefore not publish the results.

The initial study by Waight and Stewart (2005) was conducted in a corporate setting similar to the setting for this research study, that is, accessible e-learning designed as a self-paced learning experience created by or for the federal government. The primary difference is that Waight and Stewart (2005) did not address the accessibility requirement.

The results of this study can add to the literature by exploring the pedagogical aspects of accessible e-learning design. Will the production-oriented factors, such as time, technology, and human resources (Wood, 2002) outweigh the pedagogical-oriented factors of educators' conceptions and beliefs for education (Stewart & Waight, 2008)? Or, does the requirement of accessibility introduce other factors that impact e-learning design?

Connections to Research

The purpose of the research was to determine the impact accessibility requirements have on the selection of instructional strategies for e-learning. The study examined the process instructional designers apply when selecting instructional strategies for accessible e-learning. The literature states that when selecting instructional strategies, instructional designers should consider characteristics of the content and the learners (Dick et al., 2005; Joliffe et al., 2001; Morrison et al., 2004). Research showed that selection of instructional strategies is influenced by practical factors specific to the learning environment, such as pedagogical-oriented factors in the online learning setting (Wood, 2002) and production-oriented factors in the corporate setting (Stewart & Waight, 2008).

The potential influence of production- and pedagogical-oriented factors on the selection of instructional strategies for accessible e-learning was considered. In this research, instructional designers were asked to describe how they select instructional strategies for accessible e-learning and the factors which influence selection. The results add to the current literature for instructional strategy selection and document the impact, if any, of accessibility requirements.

There is a consistent taxonomy for classifying e-learning into levels of complexity as shown in Table 1 (Schone, 2007; Stewart & Waight, 2008). For this research study, the levels shown in Table 1 were used to guide e-learning classification. Based on reported percentages provided by the instructional designers interviewed, the types of e-learning were categorized within the continuum to clarify the participants' work setting.

Buzzard (2004) noted the importance of creating specific templates and tools to create accessible e-learning. The researcher inquired about templates and tools during the interview. Examples provided by study participants were helpful in identifying work practices.

The literature review included several examples of how accessibility is addressed in the creation of general websites (Petrie et al., 2004; Regan, 2004; Harper & DeWaters, 2008). Petrie et al, (2004) concluded that websites can have complex visual design and still be accessible if web developers maintain a balance between accessibility and aesthetics. Achieving and maintaining this balance requires a serious commitment to accessibility and a comprehensive plan focused on "maximizing the user's experiences and meeting business objectives" (Petrie et al., 2004, p 18). To determine if the same conditions apply to the creation of accessible e-learning, the interviews in this study included questions addressing the instructional designers' approach to accessibility and processes in place for designing accessible e-learning.

These findings support Regan's (2004) contention that accessible sites do not have to be boring; he attributes the current inadequate state of accessibility to a "failure of imagination" (p. 30). A long-term solution recommended is sustained and ongoing training "to develop better instincts for the non-visual and keyboard driven user interface" (p. 37).

There is a growing emphasis on the highest degree of accessibility, or universal design, rather than on technical standards. The literature review supports this trend in other countries (Bel & Bradburn, 2008b). To determine if this trend applies to self-paced e-learning created by or for the government, instructional designers were asked to

classify their e-learning in terms of the degree of accessibility. Classifying e-learning as universal design, accessibility, and (where necessary) accommodation provided useful data for comparing the practice of the instructional designers.

CHAPTER 3. METHODOLOGY

Chapter 3 begins with an introduction to the methodology applied for this study, multiple case study. The conceptual framework section describes the factors studied and clarifies the research questions. An overview of the methodology is provided in the research design strategy section covering the sampling strategy, case selection, and interview approach. The sampling design section covers sampling strategy, selection criteria, and selection process. The instruments and preparation steps for data collection are outlined in the measures section. The data collection procedures section focuses on how data were collected, followed by sections covering ethical issues and field testing. The data analysis procedures section addresses how the data were evaluated and analyzed. This section also addresses the accuracy of the findings and preparation of the report. The chapter concludes with the limitation of methodology section.

Introduction to Methodology

Through this study, the phenomenon of instructional strategy selection for accessible e-learning was investigated using a multiple case study design. The purpose of this study was to explore the perceptions and describe the practices of expert instructional designers to clarify the impact of accessibility requirements on the selection of instructional strategies for e-learning. The selection of instructional strategies is a specific instructional design step in the process of creating e-learning.

The literature review showed that previous research addressing accessibility focused on the creation of general websites (Petrie et al., 2004; Regan, 2004; Harper & DeWaters, 2008) and the design of instructor-led e-learning within higher education settings (Bel & Bradburn, 2008a; Burgstahler et al., 2005; Harper & DeWaters, 2008; Pearson & Koppi, 2006). Studies in higher education settings addressed accessibility issues with online courses facilitated by an instructor versus self-paced e-learning. The focus for this study was accessible e-learning designed for delivery as a self-paced learning experience.

This study adds to the limited research by investigating the contemporary phenomenon of instructional strategy selection for e-learning that must comply with Section 508 accessibility requirements. The multiple cases studied were within the domain of instructional designers with expertise in the creation of e-learning required to be compliant with Section 508 standards. Through in-depth interviews (Trochim, 2006), instructional designers' perceptions of accessibility requirements and processes for selecting instructional strategies were investigated specifically related to the design of accessible e-learning.

Conceptual Framework

The initial research question framing this study was "How do accessibility requirements influence the selection of instructional strategies?" Objectives of this study were to gain insight into instructional strategy selection during the design of accessible e-learning and to compile initial considerations for best practices and guidelines to

support the design of accessible e-learning. Core research questions supporting the objectives included the following:

1. When designing accessible e-learning, what instructional strategies do instructional designers select?

2. What processes do instructional designers apply when selecting instructional strategies for accessible e-learning?

3. How do instructional designers ensure an instructional strategy will not compromise the accessibility of e-learning?

4. How do instructional designers perceive and describe the impacts of accessibility requirements on the selection of instructional strategies?

The primary concepts which served as the framework for this study included e-learning complexity levels, factors influencing instructional strategy selection, and approach to accessibility. There is a consistent taxonomy for classifying e-learning into the complexity levels shown in Table 1. Stewart and Waight (2008) used the concept of complexity levels to classify e-learning course designs and strategies into three levels of complexity on the basis of data collected from four e-learning design teams in corporate settings. For this research study, the levels shown in Table 1 were used to guide e-learning classification on the basis of responses provided by the participants.

Instructional strategy selection for accessible e-learning was a key focus for the study. The literature indicates that when selecting instructional strategies, instructional designers should consider characteristics of the content and the learners (Dick et al., 2005; Jolliffe et al., 2001; Morrison et al., 2004). Research has shown that selection of instructional strategies is influenced by practical factors specific to the learning environment, such as pedagogical-oriented factors in the online learning setting (Stewart

& Waight, 2008) and production-oriented factors in the corporate setting (Wood, 2002). There were no published studies that addressed instructional strategy selection within the context of accessible e-learning. For this study, participants were asked to prioritize the factors that influence their choices for instructional strategies. The researcher compared the participants' factors with those documented in literature and research.

The approach to creating accessible e-learning adopted by an individual instructional designer and an organization was examined through data collected regarding tools and guidelines, obstacles and challenges, and degrees of accessibility. The existence and use of organizational-wide tools and guidelines were examined to clarify the organizations' approaches to accessibility. Participants were asked to describe obstacles and challenges encountered when applying instructional strategies. How participants coped with obstacles and challenges to accessibility exemplified the approach to accessibility. Participants were asked to categorize the e-learning they have created by degree of accessibility (M. Urban, personal communication, February 4, 2010).

Research Design Strategy

Case study research is an opportunity to examine a phenomenon through in-depth description and analysis (Merriam, 2002). In general, case studies are an appropriate research design to answer "how" and "why" questions about a specific issue (Soy, 2006; Yin, 1994). For this study, a "how" question framed the study, "How do accessibility requirements influence the selection of instructional strategies?"

The research design for this study was a multiple case study (Stake, 2005) within the context of accessible e-learning. Instructional designers' processes and perceptions

were investigated with the purpose of providing insight into the instructional strategy selection process the designers use when creating accessible e-learning. To better understand the phenomenon of instructional strategy selection, multiple cases were studied jointly rather than focusing on one particular case.

The type of purposeful sampling strategy used to identify participants was concept sampling (Creswell, 2008). To ensure participants could address the primary concepts upon which this study focused, selection was based on experience in the design of accessible e-learning. To ensure sufficient data were collected through interviews and artifacts to answer the core research questions, sampling was approached in an iterative process. The goal was to reach a sample size that supports the achievement of conceptual saturation (Sandelowski, 1995).

The type of interview conducted was based on deep questioning in a semi-structured approach (Hatch, 2002), in which the participant was interviewed for approximately 60 minutes. The interview consisted of a sequential list of open-ended questions which stemmed from the core research questions. The questions were designed to illicit participants' factual knowledge, opinions, and insights regarding the impact of accessibility requirements on instructional strategy selection.

Sampling Design

The goal of the sampling strategy, selection criteria, and selection process described in this section was to identify information-rich individuals who would provide credible data to answer the core research questions. Sampling was approached in an iterative manner to ensure sufficient data were collected. The goal was to reach a sample size that supports the achievement of conceptual saturation (Sandelowski, 1995). Concept sampling was used to collect data at a sufficient level of depth to answer the core questions and at a sufficient level of breadth to ensure no additional themes or contradictory data exists (Corbin & Strauss, 2008; Hoepfl, 1997).

A purposeful sample was identified based on the following selection criteria: (a) 10 years of experience (Fadde, 2009) designing e-learning, including experience before and after the implementation of Section 508; (b) committed to understanding the nature and meaning of accessible e-learning; and (c) willing to participate in a lengthy phone interview and possible follow-up phone interview. By applying these criteria and the concept sampling approach, selection focused on individuals who have experienced with the concepts which served as the framework for this study including e-learning complexity levels, factors influencing instructional strategy selection, and approach to accessibility.

U.S. government agencies have appointed individuals to serve as Federal Section 508 Coordinators for their respective agency. The coordinators are responsible for organizing and supporting Section 508 implementation within their organization and serve as the main point of contact for issues related to accessibility (U.S. General Services Administration, 2010). To promote heterogeneity of participants and ensure a

cross-section of government is represented, Section 508 Coordinators from thirty-two agencies were asked to recommend instructional designers who design 508-compliant e-learning either employed by the agency or a commercial company providing instructional design services to the agency. The Section 508 Coordinators were informed of the study purpose and selection criteria upon which to base their recommendations.

To solicit participation, a recruitment letter was emailed to each prospective participant identified by Section 508 Coordinators. The letter requested that the prospective participant return the Informed Consent Form by fax or email to the researcher if they agreed to participate in the research study. By returning the signed informed consent form participants provided consent to participate in the interview and follow-up interview. Solicitation of participants concluded once sufficient data were collected to answer the core research questions.

For qualitative studies there are no firm criteria for the sample size (Patton, 1990). Sample size should be based on reaching the point of redundancy or conceptual saturation of the data (Sandelowski, 1995). The original proposed sample size for this study was five to nine participants. This estimate was based on Creswell's (2002) recommendations and sample sizes reported for two studies which offer parallels to this research study. Creswell (2002) recommended three to five as the sample size for case study research. Wood's (2002) case study to explore the selection of instructional strategies for web-based learning environments had a sample size of nine individuals. Waight and Stewart case study explored instructional strategy selection for self-paced e-learning in a corporate or government by four e-learning teams.

Upon completion of seven interviews and initial analysis, there was insufficient data representing a cross-section of the sample. Six of the seven participants were employed by commercial companies that provide instructional design services to the government. To locate participants employed directly by the government, the researcher emailed the request to the five Section 508 Coordinators who replied to the initial recruitment. Three additional prospective participants with 508-compliant e-learning experience were recommended. The final sample for the study was 10 participants, six from the commercial company work setting and four from the government work setting.

The researcher followed the first portion of the Interview Guide (see Appendix A) to screen all prospective participants and ensure each met the selection criteria. Each prospect was asked to describe the education and work experience they have had in instructional design and e-learning. The preferred but not required minimum education was a master's degree in education. The required work experience was at least 10 years of experience with the described phenomenon. The theory of expert performance guided the identification of appropriate study participants in that only designers with at least 10 years of experience designing e-learning were included (Fadde, 2009).

Measures

The instrument to support this study was the Interview Guide (see Appendix A). An opening and closing script was included in the Interview Guide to ensure consistent data collection methods were applied for each interview. The first portion of the Interview Guide was used to screen prospective participants by telephone and collect background data, such as related education and instructional design experience. The

background data were used to determine if the participant met the selection criteria. This initial structured dialogue was an opportunity for the researcher to establish a positive rapport and a foundation of trust with the participant to evoke open and frank responses (Hatch, 2002).

The Interview Guide included open-ended questions to facilitate deep questioning in a semi-structured approach (Hatch, 2002). The interview consisted of a specific sequential list of open-ended questions which stemmed from the core research questions. The researcher tracked the time spent per question to ensure the interview did not exceed 90 minutes.

A portion of the questions in the Interview Guide were adapted from Wood's (2002) case study research in which Wood explored what instructional strategies educators select. Wood's core research question was "What influences the selections of instructional strategies for web-based instruction?" (Wood, 2002, p. 49). The setting for Wood's study was an online graduate level course titled "Online Instructional Strategies" (Wood, 2002, p. 51). In that study, Wood chose an embedded case study design to examine seven mini cases in the context of one larger case. The research examined the phenomenon of instructional strategy selection within the real-life context of the online course.

Researcher's Role

The topic of this study, impact of accessibility requirements on instructional strategies for e-learning, engages the researcher both intellectually and emotionally, indicating personal and social significance. As an instructional designer for a U.S. government agency since 1987, the researcher has encountered both the frustration and

fulfillment of creating accessible e-learning. To ensure the researcher suspended her presuppositions and avoided premature interpretations, the researcher maintained a journal and recorded interview notes in brackets (Hatch 2002). During the interview and initial analysis, when the researcher had reactions or reflections, the researcher recorded those thoughts by hand as notes in brackets. Before and after each interview, the researcher made electronic journal entries to "openly reflect on what is happening during the study" (Hatch, 2002, p. 2) and incorporated the bracketed notes in the journal.

Data Collection Procedures

There were four elements of data collection for this study. These included the interview, member checking, artifact collection, and researcher's journal. The procedures used for collecting the data for this study through each of these elements are presented below.

Prospective participants were screened by telephone using the first portion of the Interview Guide. The purpose of this initial contact was to determine if the prospective participant met the selection criteria. Participants were assured that their identity and organization's identity would remain anonymous and confidential. Participants were informed that the interview would be recorded and transcribed. At the conclusion of screening questions, the researcher would determine whether the prospect met the selection criteria. Each of the 10 prospective participants met the criteria and the researcher proceeded with the interview following the Interview Guide.

The complete interviews ranged in length from 40 minutes to 70 minutes with an average of 60 minutes. The goal of the interview questions was to gain insight on the instructional designers' decision-making processes for selecting instructional strategies for accessible e-learning. The questions were open-ended questions to better explore the perceptions and approaches of the instructional designers and to facilitate reflection as to how accessibility requirements have or have not influenced practice. Each interview concluded with the question, "Is there anything else you would like to say about your work with instructional strategies and accessible elearning that we have not covered?" to ensure collected data were complete.

Within 10 days of conducting the interview and receiving the transcript, an initial summary was prepared and emailed to the participant. Participants were asked to review and verify the initial interview summary and consider whether the summary correlated with the participant's reality. Each summary was based on the interview transcript; the researcher's notes and journal entries were not reflected in the initial summary. Participants were asked to suggest clarifications so the interview summary better reflected the participant's perspective (Hatch, 2002; Merriam, 2002). Nine of the 10 participants concurred with the accuracy of the initial summary. One participant provided additional information regarding work experience and alerted the researcher to an error in the summary.

As a result of data collection and analysis being conducted in an iterative manner, after completing five interviews, the researcher recognized that the descriptions of e-learning provided by participants were not providing sufficient detail for the researcher to classify the e-learning into the three complexity levels as defined in Table 1. A follow-up

question was created to determine the percentage of accessible e-learning participants create for each of the three levels of complexity. For consistency, the follow-up question was administered through email to all participants and all 10 participants provided responses.

During the interview when a participant referenced a potential artifact, the researcher inquired as to whether the item was shareable and asked permission to examine the resource (Creswell, 2008). Two questions specifically asked participants for artifacts. Artifacts, such as documents defining the instructional strategies participants have used in e-learning, were used to exemplify design practices and substantiate data consistency.

Throughout the study, the researcher recorded reflections and concerns regarding the context of each case and issues with data collection, analysis, and interpretation in the researcher's electronic journal. The researcher maintained a reflective journal to serve as an "audit trail" (Friesen, 2009), a "running record" (Merriam, 2002, p. 27) of the researcher's interactions with the data. Reactions or reflections that occurred during the interviews were recorded by hand as bracketed notes and transferred to the electronic journal after each interview. To suspend expectations and assumptions the researcher reviewed journal entries that captured the researcher's pre-interview perceptions. The journal served to document the assumptions, perceptions, and potential misinterpretations the researcher brought to each interview. The researcher did not encounter any presuppositions that had the potential to interfere with the researcher's ability to accurately code the data.

Ethical Issues

During data collection, steps were taken to ensure the protection of participants and the integrity of the study. Participants were informed of the research purpose and process. While the topic of accessibility for e-learning is not extremely sensitive, Section 508 is a legal requirement that applies to the study participants. Each participant was required to provide a signed Informed Consent Form. Participants were informed of the option to withdraw from the study at any point if confidentiality was perceived to be breached.

To ensure participants spoke candidly, steps were taken to guarantee anonymity and privacy. The researcher performed all interviews in a private location. A commercial transcription service was used to transcribe the interviews. The transcription service has over 20 years of experience providing professional transcription services. The researcher has a positive work relationship with the transcription service for over 10 years. The transcription service provided a confidentiality agreement signed by the transcription staff involved. Participants were assured that their identity and organization's identity would remain anonymous and confidential. The researcher replaced all participants' names with pseudonyms in the transcript. All references to company names and government agencies were blacked out or replaced with generic text.

Field Testing

Prior to data collection and IRB approval, the primary data collection instrument, the Interview Guide, was field tested in the form of expert review by five individuals. These individuals represented the following areas of expertise: instructional design, web

accessibility, and e-learning development. The goal of field testing was to obtain input from experts regarding the strength of the Interview Guide as a data collection instrument for the purpose of determining the impact of accessibility requirements on the selection of instructional strategies for e-learning.

Three of the experts were instructional design practitioners that met the selection criteria for study participants. Two of the experts were Federal Section 508 Coordinators. The five experts represented three federal agencies. The researcher had worked directly with two of the experts. The researcher had not worked directly with the other three experts, one instructional design practitioner and two Federal Section 508 Coordinators. Each expert was provided the research purpose statement and the four core research questions. For each core research question, the Interview Guide contains a subset of interview questions to support data collection. These subsets are identified in Table 5. Each subset of interview questions was orally presented to the expert in order to obtain the experts' insight as to the strengths and weaknesses of the Interview Guide as a data collection tool.

The experts stated that the wording of the interview questions was stilted. They noted phrases that did not use language appropriate for use in a verbal interview. The experts stated that the context was not clear. They recommended defining the terms instructional strategy and accessible e-learning at the beginning of the interviews to clarify the context of the study. One expert noted that asking the participants to describe the types of e-learning they create was too broad. There were two questions, the experts recommended removing. The first was a question that asked participants about their thoughts on the accessibility requirement. The experts did not think this question would

result in any additional useful or pertinent information given the other questions in that subset. The second question recommended for deletion asked participants about the impact accessibility requirements have to their approach to development of e-learning. The experts noted that this question did not directly support the research purpose and moved the focus away from instructional strategy selection and into the broader domain of development. During the walk through of the instrument, the experts offered possible answers to anticipate from the participants. Experts noted that the interviews would likely last longer than 60 minutes.

Table 5. Data Collection and Analysis Procedures by Core Research Question

Core research question	Data collection	Data analysis
When designing accessible e-learning, what instructional strategies do instructional designers select?	Interview questions 2, 3, 9 Artifacts	Examine text for themes related to instructional strategy selections Review artifacts shared
What processes do instructional designers apply when selecting instructional strategies for accessible e-learning?	Interview questions 4, 5 Artifacts	Examine text for themes related to the process and factors for instructional strategy selection Align ranked factors into groups based on factors noted in literature (pedagogical and production) and work setting Review transcript and artifacts for work practices
How do instructional designers ensure an instructional strategy will not compromise the accessibility of e-learning?	Interview questions 6, 7, 8, 10, 11 Artifacts	Examine text for themes related to reported work practices Review artifacts shared for tools, guidelines, checklists, and work practices
How do instructional designers perceive and describe the impacts of accessibility requirements on the selection of instructional strategies?	Interview questions 12, 13, 14	Examine text for themes related to approach to accessibility Compare approaches based on reported degrees of accessibility

The Interview Guide was modified to address the weaknesses noted by the experts. Edits were made so the script would be appropriate for oral delivery using more common terminology. Definitions for instructional strategy and accessible e-learning were inserted. The question asking participants to describe the types of e-learning was edited to focus on type of content and learning goal. The two questions the expert recommended deleting were removed. The possible answers noted by the experts were used as probes if needed. The research methodology was adjusted to indicate a potential interview time of 90 minutes.

Data Analysis Procedures

The data analysis procedures correspond to Creswell's six steps to analyzing and interpreting qualitative data: 1) Preparing and organizing the data, 2) Exploring and coding the database, 3) Describing findings and forming themes, 4) Representing and reporting findings, 5) Interpreting the meaning of the findings, and 6) Validating the accuracy of the finds (Creswell, 2008). Table 5 shows the relationship between each core research questions and the data collection and analysis procedures. Steps 1 through 3 were applied to each element of data collected in a concurrent manner rather than strictly linear (I. T. Coyne, 1997; Hoepfl, 1997). Concept sampling was used to collect data at a sufficient level of depth to answer the core questions and at a sufficient level of breadth to ensure no additional themes or contradictory data exists (Corbin & Strauss, 2008; Hoepfl, 1997). To track the degree of conceptual saturation (Sandelowski, 1995) as data were collected, the first three steps of data analysis were initiated upon receipt of the interview transcript. Concurrent collection, coding, and analysis were critical to ensure

conceptual saturation (I. T. Coyne, 1997; Sandelowski, 1995). Table 5 shows the relationship between each core research questions and the data collection and analysis procedures.

Preparing and Organizing the Data

With qualitative studies, such as multiple case studies, the large volume of data collected can be overwhelming. Therefore, the initial step of preparing and organizing the data is especially critical. In addition to the interview data, the researcher organized and analyzed the data from the researcher's journal and artifacts collected.

As data were collected it was organized by participant. A large accordion folder was used to consolidate and organize all the data using one slot for each participant. The recordings for each interview were transcribed and provided to the researcher as a text file. Transcriptions were made by a commercial transcription service. The transcription included all of the spoken words and other actions such as pauses, laughter, and interruptions (Creswell, 2008). The researcher revised the transcript by replacing all references to names with pseudonyms and blacking out references to specific organizations or replacing with generic descriptions.

Journal entries made by the researcher before and after each interview were also referenced. During the interview, the researcher used the bracketing technique to record her reactions and reflections. The researcher recorded these thoughts by hand as notes in brackets to set them apart from any notes that apply to the participants. The bracketed notes were transferred to the journal after each interview.

Exploring and Coding the Database

For each case, coding began once the transcript was received, member checking of interview summary was complete, and artifacts were collected. Through coding, the researcher noted repeating factors and patterns that signified possible broad themes and provided a sense of the whole (Creswell, 2008). The researcher would listen to the interview recording, read the transcript and read the interview summary three times to get a general idea of participants' perceptions (Hatch, 2002). An online text analysis tool was used to identify repeated words and phrases in the interview transcript. The resulting analysis did not reveal patterns or themes.

To facilitate coding, the transcript text file had a large right margin. The researcher inserted text boxes in the margin each containing two or three code words or phrases. Once the researcher completed this process with an interview, the code word text boxes were compiled and analyzed for redundancy. According to Creswell (2008), it is best to reduce the number of codes to a manageable number such as 25 to 30.

Describing Findings and Forming Themes

To develop the details of each case, the researcher examined all the data elements associated with a case including the interview summary, coded transcripts, and artifacts. For each case, the codes inserted in the transcript were compiled into a master list of codes. Initially there were 70 code word text boxes. The list of codes was further analyzed by grouping the codes into categories. The text boxes containing redundant codes were stacked and the text boxes containing codes that did not immediately appear

relevant to the study were set aside in a miscellaneous category. After redundant code words were merged and code words not relevant to the research questions were removed, there were 39 code word text boxes.

Themes emerged as three or more codes naturally clustered together and were grouped under the broad categories. Data collection and analysis continued in an iterative manner until there were no additional themes or contradictory data emerging (Hoepfl, 1997). The codes set aside in the miscellaneous category were re-analyzed for relevance.

Representing and Reporting Findings

The report of the findings presented in chapter 4 was based on the results of the systematic data analysis procedures (Hatch, 2002) and includes visuals and text. Visuals include comparison tables and figures and excerpts of design artifacts provided by participants. The text describes the findings in terms of the research questions and includes narrative and participants' quotes.

Interpreting the Meaning of the Findings

The researcher formulated an interpretation of the findings by coalescing her knowledge of relevant literature and studies, in-depth familiarity with the study findings, and personal views and experience. The interpretation for each research question is presented in chapter 5 and includes descriptions of the research context, provides sufficient richness of data, and clarifies assumptions (Friesen, 2009; Trochim, 2006). The goal of the report is to elucidate the phenomenon of instructional strategy selection for accessible e-learning and to take the reader inside the issues and context of the study (Hatch, 2002).

Validating the Accuracy of the Findings

For qualitative research, Lincoln and Guba (1985) proposed four criteria for judging quality. The four criteria include credibility, transferability, dependability, and confirmability. The steps applied to ensure adherence to these criteria are outlined below.

Credibility is achieved when participants judge the results of the study as believable and credible (Trochim, 2006). Two techniques used in this study to achieve credibility include limiting study participants to experts in the design of accessible e-learning and member checking. The credibility of the study was strengthened by ensuring participants met the selection criteria of having at least 10 years of experience in instructional design of e-learning and were employed by a commercial company that creates accessible e-learning under contract with the government or employed directly by a government agency. Member checking was accomplished by providing study participants the opportunity to review and comment on the researcher's summary of the interview. Obtaining the participant's concurrence with the summary contributes to the credibility of the study.

Transferability is achieved when the results of the study can be applied in or transferred to other settings (Trochim, 2006). It is the responsibility of the reader to determine how transferable the results of this study can be to their specific context. To facilitate transfer, the researcher recruited a cross-section of instructional designers in terms of demographics and work setting. Readers are provided a thorough description of the research context, sufficient richness of data through narrative and quotes, and clarification of assumptions (Friesen, 2009; Trochim, 2006).

With qualitative research the concept of dependability refers to the constantly changing context of the research setting. To address dependability, the researcher described the "audit trail" (Friesen, 2009, p. 146) which documented the context, changes that occurred in the context, and how these changes impacted the study. The audit trail includes the researcher's journal, transcripts of participant interviews, and the original and revised versions of each interview summary.

Confirmability refers to the ability of the results to be confirmed by others. Confirmability is dependent upon the researcher's demonstration of the "neutrality of the research interpretations" (Hoepfl, 1997, p. 60). To confirm that the data collection instrument, the Interview Guide, would be effective, a field test was conducted with five experts. These experts reviewed the instrument to determine its strength for data collection. The audit trail that is used to document dependability was also used to document confirmability (Hoepfl, 1997). The researcher's neutral and balanced approach to interpretations can be confirmed by readers by referencing the researcher's journal, transcripts of participant interviews, the original and revised versions of each interview summary, and artifact excerpts.

Limitations of Methodology

The researcher identified three potential limitations of the methodology. The first limitation was that study participants consisted of a specific subset of instructional designers; that is those instructional designers employed by government agencies that create accessible e-learning or employed by commercial companies that create accessible e-learning under contract with the government. The second limitation was that all

interviews with study participants were conducted by phone. The third limitation was the researcher's limited experience in conducting qualitative studies of this nature.

In order to locate instructional designers with expertise in the design of accessible e-learning solicitation of study participants was limited to a work context in which accessible e-learning has been required by law since 2001. To ensure readers from non-government settings recognize the applicability of the study results to their work setting, information-rich narratives, illustrative quotes, and select artifact excerpts are included. To facilitate transfer, the researcher recruited a cross-section of instructional designers in terms of demographics and work setting.

Study participants were geographically dispersed and all interviews were conducted by telephone. Limiting the data collection to phone interviews limited the non-verbal data the researcher could collect. With this remote method of information gathering, the researcher did not have direct visual contact with participants. This limitation could have hindered the researcher's ability to fully understand participant's perceptions (Creswell, 2008). This also could have hindered the establishment of a productive rapport with the study participants. To strengthen rapport, the researcher took special care to be courteous and respectful to participants. Every encounter with prospective participants was used as an opportunity for the researcher to establish positive rapport. All correspondence and interactions were conducted in a timely and professional manner.

With qualitative research, it is assumed that researchers conduct the exploration of the research questions in a "subjective, biased manner" (Creswell, 2008 p 46), but should aim for "empathic neutrality" (Patton, 1990, p. 55). In this study, the empathy was aimed

at the instructional designers as they address the phenomenon of determining instructional strategies for accessible e-learning. The neutrality addresses the researcher's "non –judgmental" (Hoepfl, 1997) approach to data collection, analysis, and interpretation. To ensure readers are aware of the researcher's neutral approach, the researcher maintained a journal throughout conducting the study to record reflections and concerns regarding data collection, analysis, and interpretation. The journal documents the assumptions, perceptions, and potential misinterpretations the researcher might have brought to each case.

CHAPTER 4. RESULTS

Introduction

The literature review in chapter 2 reported a significant amount of research on the selection of instructional strategies for e-learning and on accessibility requirements. However, research specifically on the combination of those two areas, that is, the selection of instructional strategies in the domain of accessible self-paced e-learning, is lacking. The process employed by expert instructional designers to select instructional strategies and the factors that influence selection have not been described in the literature.

This research study was designed to provide insight into the impact accessibility requirements have on the selection of instructional strategies for e-learning within the context of self-paced e-learning procured, used, or developed by U.S. federal government. The primary results of the study revolve around the work practices of expert instructional designers as they select instructional strategies for accessible e-learning and ensure the e-learning is accessible. The results include insights into the instructional strategies that work for accessible e-learning, the factors that influence instructional strategy selection, and the underlying work practices of the participants.

This chapter uses text and visuals to present the findings of the study. The first section provides a description of the participants based on demographics and work setting data. The next section provides an overview of the research methodology used. A detailed description of the analysis methods used for this study is provided in chapter 3.

In the fourth section of this chapter the data and results for each of the four research questions are presented. The final section provides a summary of the results and concludes the chapter.

Description of Participants

A purposeful sample of 10 experts was selected from multiple organizations within the domain of accessible e-learning created for or by the U.S. federal government. In addition to demographic questions, participants were asked to describe their work setting as it relates to e-learning experience. Data describing the participants are reviewed in this section.

Participant Demographics

Participant demographics data are summarized in Table 6. Of the 10 participants, six were female and four were male. The highest degree of education for four participants was bachelor's degree. Three participants had earned master's degrees and three had earned doctoral degrees. Six participants were employed by commercial companies that create accessible e-learning under contract with the government and four were employed directly by government agencies. Each participant had at least 10 years of experience in instructional design. The total number of years of instructional design experience reported by participants was 181. The number of years of experience ranged from 10 years to 30 years with a median of 15.5 years.

Table 6. Participant Demographics (N = 10)

Demographic	Frequency	%
Gender		
Female	6	60
Male	4	40
Highest education level		
Bachelor's degree	4	40
Master's degree	3	30
Doctorate degree	3	30
Work Setting Represented		
Commercial company under contract with government	6	60
Government agency	4	40
Years of Instructional Design Experience		
10-14	4	40
15-19	2	20
20-24	2	20
25-29	1	10
30+	1	10

E-Learning by Type of Content

Participants were asked to describe the e-learning they created in terms of the type of content. Table 7 shows a summary of the types of content reported. Of the content types reported, 33 % were healthcare oriented such as clinical, medical, and health communications. Information technology training such as computer procedures and software tutorials accounted for 27% of the reported content. E-learning for human resources policy and other policy driven content was reported for 20% of the content. Required internal training such as orientations, diversity training, and safety training was reported for 20% of the content.

Table 7. Frequency of E-Learning by Type of Content ($N = 10$)

Demographic	Frequency	%
Healthcare	5	33
Information technology	4	27
Policy driven	3	20
Required internal training	3	20

E-Learning by Type of Learning

Participants were asked to describe the e-learning they created in terms of the type of learning. Table 8 shows a summary of the types of learning reported. Of the learning types reported, 54% was cognitive-type learning for knowledge gain and 46% was focused on skill building, specifically computer procedures and software tutorials. "Beth" summarized her e-learning experience in terms of the type of learning, as follows:

> A lot of it is informational. Most of it is cognitive. We do very little that we consider psychomotor or affective. Mainly cognitive, with the exception, computer procedures to me are kind of a mix so that is more skill building but generally anything that's computer procedures in addition to the skill building side you also have more your informational things in terms of business processes . . . . A lot of policy procedural types of learning goals.

Complexity Levels for Accessible E-Learning

A follow-up question was emailed to participants in order to obtain specific data on e-learning complexity (Appendix B). Each participant was asked to report the percentage of accessible e-learning developed in their work setting by level of complexity. Complexity Level 1 e-learning was described as having low interactivity where a learner moves from page to page with no control over the sequence. The learner

has some control over sequence and presentation of content with Level 2 e-learning. Level 3 e-learning includes complex interactions and presentations of content that are influenced by the learner's decisions and the choices. All 10 participants responded by email to the follow-up question. The results are shown in Table 9.

Table 8. Frequency of E-Learning by Type of Learning (N = 10)

Type of learning	Frequency	%
Knowledge gain	7	54
Skill building	6	46

Table 9. Reported Percentages of Complexity Levels for Accessible E-Learning (N = 10)

Participant	Level 1 % (low interactivity)	Level 2 % (medium interactivity)	Level 3 % (high interactivity)
Ann	50	50	0
Beth	20	80	0
Henry	65	20	15
Jean	30	60	10
Jim	40	35	25
Lisa	40	35	25
Mike	60	40	0
Nell	20	60	20
Pam	50	50	0
Tom	60	35	5
Average	43.5	46.5	10

Five of the 10 participants assigned the highest percentage to Level 1 e-learning and three assigned the highest percentage to Level 2. Two participants assigned equal ranking to Level 1 and Level 2 at 50% each. No participant ranked Level 3 as the highest. Four participants reported they develop no Level 3 e-learning. Level 2 received the highest average percentage at 46.5%. This was closely followed by Level 1 with 43.5% as the average. The average of the percentages reported for Level 3 was 10%.

Methodological Approach

This section provides an overview of the methodological approach applied to obtain the data for the study. For a detailed account of the analysis methods used for the study see chapter 3.

After receipt of the interview transcript, the researcher prepared a summary of the interview and emailed the summary to the participant for review. Initial coding of the interview transcript occurred once the participant concurred with the summary and provided artifacts, if applicable. The researcher analyzed the transcripts and artifacts noting patterns and possible themes. As the number of analyzed transcripts and artifacts increased, the researcher noted significant and repeating patterns which led to the identification of themes. Analysis of the data collected for this study revealed twelve repeating themes which aligned with the four core research questions. The data and analysis results for the study are presented in the following four sections, one section for each research question.

Instructional Strategies for Accessible E-Learning

The first core research question was "When designing accessible e-learning, what instructional strategies do instructional designers select?" The data collected to address this question consisted of participants' responses to three interview questions (questions 2, 3, and 9) and artifacts provided by participants.

Participants were asked to list the instructional strategies they select for accessible e-learning and to provide documents in which they describe or illustrate the instructional strategies. Participants were asked if there were any instructional strategies that created accessibility challenges. Instructional strategies were defined as techniques and methods used to relay content to learners in support of the learning objectives. The examples provided by the researcher to clarify the interview question were voice-over narration, annotated diagram, interactive animation, scenario-based exercise, and assessment activity.

The following two themes emerged from the data about instructional strategies for accessible e-learning: Strategies that work and strategies that do not work.

Instructional Strategies That Work

The participants identified 10 instructional strategies as strategies that work for accessible e-learning. Table 10 shows the frequency of each instructional strategy cited. Seven of the 10 participants listed scenarios (15.6%) as a strategy they use in accessible e-learning. Scenarios, which were also referred to as case studies, were used to engage the learner. "Nell's" support for scenarios stems from her goal to have the learner "go through a process that's as near to the real thing as we can get without actually doing it."

“Beth” supports the use of scenarios and acknowledged “We like to use scenarios whenever possible. I think it’s a great strategy in general and theoretically there are no restrictions around it in terms of 508 or accessibility.”

Table 10. Frequency of Instructional Strategies That Work for Accessible E-Learning ($N = 10$)

Instructional strategy	Frequency	%
Scenario	7	15.6
Multiple choice question	5	11.1
Quiz and assessment	5	11.1
Animation	5	11.1
Voice-over narration	5	11.1
Graphics	5	11.1
Video	4	8.9
Text	4	8.9
Matching question	3	6.7
Drag and drop question or activity	2	4.7

Various forms of quizzes and assessments were cited as instructional strategies for accessible e-learning. Specific assessment strategies listed include multiple choice question, matching question, and drag and drop activity. Five participants identified multiple choice questions (11.1%) which included true-false questions as an instructional strategy that works. From “Nell’s” viewpoint there were too many multiple choice questions. She stated “I found that when I was really trying to do accessible stuff, there was a lot of multiple choice, multiple choice, multiple choice.”

Drag and drop activities (4.7%) were listed by two participants as an instructional strategy they use for accessible e-learning. However, both participants expressed limitations of this strategy for accessible e-learning. “Henry” recognized that accessible drag and drop activities “end up being a kind of keyboard based click and accept kind of an activity.” “Ann” admitted that the use of drag and drop presents a “huge, huge hurdle to overcome.” As a contractor for a government agency, “Ann” must adhere to the agency’s e-learning development guide (see Figure 1). The guide includes design conventions and standards such as the specification that for “knowledge reviews” the following four question formats are accessible: true/false, multiple choice (one correct answer), fill in the blank, and multiple select (more than one correct answer).

The following forms of media were listed as instructional strategies that work for accessible e-learning: animation, voice-over narration, graphics, and video. Five of the 10 participants identified animation (11.1%) as an instructional strategy choice. Three of the five participants citing animation as a choice, stated that they use Adobe Flash to create the animation. “Beth” provided proprietary documentation from her company which lists Flash as an acceptable tool and specifies the steps to ensure accessibility of Flash output.

“Ann” takes issue with other instructional designers when they say, “oh it has to be 508 compliant so we can’t use this, we can’t use drag and drop, we can’t use this, we can’t use Flash.” “Ann” shared her stance that “if that’s the tool [Flash] or the method of choice we want to use, then we’re gonna find a way to make it accessible.” Likewise, “Lisa’s” approach to instructional strategy selection was that “creativity is the key to accessibility. Find out what can be done – not what cannot be done.”

7.2 Knowledge Review Question Guidance

Knowledge reviews allow learners to practice questions similar to those on an exam in order to determine their readiness for moving forward. Review questions often rely on one of four formats:

1. true/false
2. multiple choice: one correct answer
3. fill in the blank
4. multiple select: more than one correct answer

Review questions in other formats may be developed and are encouraged. Those formats must comply with the standards and guidance contained in this document.

Review questions must provide feedback. For CL modules, the feedback may be either confirmatory (correct or incorrect) or explanatory (include why the choice is correct/incorrect). For DL courses, the feedback must be explanatory. Feedback must also indicate number of attempts when the question format allows learners more than one try.

Example: Multiple Select Feedback

- Correct response feedback: "*Correct! These three subroutines are always critical to mission success.*"
- Incorrect 1st response: "*Either not all correct answers are selected, or an incorrect answer is selected. Please try again.*"
- Incorrect 2nd response: "*Please make one more attempt.*"
- Incorrect 3rd response: "*You are out of tries. Subroutines 1, 2, and 3 are always critical to mission success. The others are applied only in specific circumstances.*"

GUIDANCE: Every ELO must be supported by an appropriate number of knowledge review questions. Learners should receive enough questions to determine whether or not they have mastered the ELO and are ready for the exam. These interactions may be interspersed throughout the presentation of the ELO's content but must occur no later than the end of the ELO.

Figure 1. Design conventions and standards for knowledge reviews. Excerpt of a government agency's e-learning development guide to which contractors must adhere. CL = continuous learning module; DL = distance learning course; ELO= enabling learning objectives.
Source: Design Conventions and Standards for Knowledge Reviews courtesy of Participant "Ann". (Used with permission).

Voice-over narration (11.1%) was reported by five of the 10 participants as an instructional strategy they use for accessible e-learning. "Ann" advocates for the use of narration and claimed, "A lot of what the [accessibility] challenges that we face can be overcome simply by using appropriate narration. You don't even need a screen reader."

Instructional Strategies That Do Not Work

Participants were asked if there were any instructional strategies they have found create accessibility challenges and could not be used. Eight of the 10 participants identified at least one instructional strategy that does not work (Table 11). Two of the participants reported that there were no instructional strategies that created accessibility concerns (16.7%).

Table 11. Frequency of Instructional Strategies That Do Not Work for Accessible E-Learning ($N = 10$)

Instructional strategy	Frequency	%
Virtual world/Simulation with both visual and dragging action	5	41.7
Flash animation	3	25.0
Drag and drop question or activity	2	16.7
None	2	16.7

Five of the 10 participants reported that a virtual world or simulation type instructional strategy (41.7%) would not be accessible. “Tom” and “Beth” clarified that when a drag and drop activity is more like a simulation that is, requires both visual and movement sensation, creation of an accessible version is impossible and alternative approaches must be adopted. The one situation “Ann” said she would “struggle with accessibility” is in a virtual world. “Jean” concurred as follows:

> There are certain kinds of interactions, for example, that cannot be made 508 compliant and so sometimes we cannot have the exact same experience. Like a virtual world, for example. So in that case we just cannot have the same experience.

There were discrepancies among the participants as to whether or not Adobe Flash output was accessible. According to three of the participants the output of Flash (25%) is not currently 508 compliant. "Jim" acknowledged that Flash is "very difficult to make a 100% accessible." He explained that the W3C standard "states that you can't require someone to install a plug-in, which is what Flash uses." To ensure the e-learning he creates is accessible, he avoids the use of any media such as Flash that requires a plug-in for the screen reader. However, he sees this limitation diminishing as "85-90% of the current screen readers . . . were able to run Flash content" without need for plug-in.

Two of the participants listed drag and drop (16.7%) as an instructional strategy that cannot be made accessible or at least is challenging to make accessible. When an activity requires the learner to perceive a visual message and react through a motion action, accessibility is a challenge. However, when the activity can be reduced to a question format it can then be made accessible. To clarify the distinction between an activity presented as an accessible question and a non-accessible simulation, "Beth" offered the following example of a non-accessible interaction she designed for a commercial grocery chain:

> For example, we did a course for grocery store baggers and we wanted to simulate the process of bagging in terms of not putting your bananas on top of your bread. So to make it as real as possible, if you can envision the screen, it's the bagger's eye view of the checkout counter so it's like you're standing there looking at the area where the cashier sends all the groceries to be bagged and you've got three bags in front of you that already have stuff in it and you're supposed to drag which bag would you drag the bread to, which bag would you drag the bananas to and which bag would you drag the bleach to. So that visual approach and that dragging action creates [sic] something that's extremely similar to the job. So at that point I don't really call it a question, I'd call that a simulation. . . . I would say questions I can use freely with an accessible course but simulation very often I can't.

"Beth" provided internal documentation from her company which specifies that for tests and quizzes designers are not to use "matching, drag and drop or hot spots because they require vision and/or mobility." The document also specifies that timed responses should be avoided but if used the designer is to provide "AT students [learners with disability using assistive technology] more time to complete."

Instructional Strategy Selection

The second research question was "What processes do instructional designers apply when selecting instructional strategies for accessible e-learning?" The data collected to address this question consisted of participants' responses to two interview questions (questions 4 and 5). Participants were asked to describe the process they use to choose instructional strategies and to list the factors that influence those choices in order from most influential to the least.

When asked to describe the instructional strategy selection process, no participant delineated a process specifically for selecting instructional strategies for accessible e-learning. "Lisa" was the only participant who described a process; she uses an interview tool titled "Tell Me a Story", to guide the initial analysis steps for all training development projects. Through this tool she gains a "good understating of the need -- what is happening now, why this project is being done, and how it will ultimately provide value to the people who will use it".

In answer to the question about process, six of the participants cited factors that influence the selection of instructional strategies. Five of the 10 participants focused on the significance of the performance goal as a factor influencing selection. "Ann" stated

that she determines instructional strategies by brainstorming "what activities would support the learner being able to do what the client requests they be able to do." "Beth" uses a technique that "keeps e-learning focused on performance instead of just knowledge dump." One participant cited cost constraints as a critical factor influencing instructional strategy selection.

Participants were asked to list the factors that influence their choices for instructional strategies in order of priority, from most influential to the least. The researcher divided the reported factors into two sets, pedagogical and production. Pedagogical factors are those that stem from the educators' conceptions and beliefs for education and are based on the designer's knowledge of learning theories such as information processing theory, adult learning theory, and social learning theory (Stewart & Waight, 2008). Production factors are those based on concerns about technology and production such as time, technology, and human resources (Wood, 2002).

Previous research showed that in an academic setting, instructional strategy selection was more strongly influenced by pedagogical factors (Wood, 2002). While in the corporate setting, instructional strategy selection was influenced more by production factors. To determine if there were variations in reported factors based on work setting, responses were compared among the participants employed by a government agency and those employed by a commercial company under contract with the government.

The three themes that emerged were the consistent high degree of influence of pedagogical factors, inconsistency among the degree of influence of production factors,

and limited citing of accessibility as a factor. Participants' responses to the questions included references to their standard work practices. The work practices applicable to accessible e-learning are listed in Appendix C.

Consistent High Degree of Influence of Pedagogical Factors

When asked to list the factors that influence the instructional strategy selection, all participants reported learning objectives, content, or target audience as a factor. Participants were then asked to rank the factors from most influential to least. The ranking of pedagogical factors from most influential (displayed as a 1) to least influential (displayed as a 5) are shown in Figure 2. Of all the pedagogical factors, learning objectives received the highest ranking from both work setting groups. Eight of the 10 participants ranked learning objectives as either the most or second-most in terms of influence. "Ann" explained the value of learning objectives as follows: "So in a perfect world when we're doing things the way I perceive that we should do things, is [sic] the learning goals are the Holy Grail, that's what we're trying to get."

Content was listed by six of the 10 participants with an influence ranking of 1, 2, or 3. Two of the six were from the government work setting and four were contractors. Four of the 10 participants assigned an influence ranking of 2 or 3 for the target audience pedagogical factor. Three of the four were from government work setting and one was a contractor.

There was one pedagogical factor reported by two contractors that was not reported from any government participant. "Beth" and "Nell" both referenced learner engagement as a factor. "Beth" referred to this as the "WOW factor" which she considers

for “dry content” to “increase interest level/engagement level through high level of interactivity.” “Beth” explained from the standpoint of a commercial company as follows:

> Their courses have to compete in a marketplace, and because of that we need to make sure that we’ve got a really high level of interactivity, high level engagement, even maybe more so than the instructional strategy purist would dictate. It could be 100% instructionally sound but if it was ugly, it wouldn’t sell.

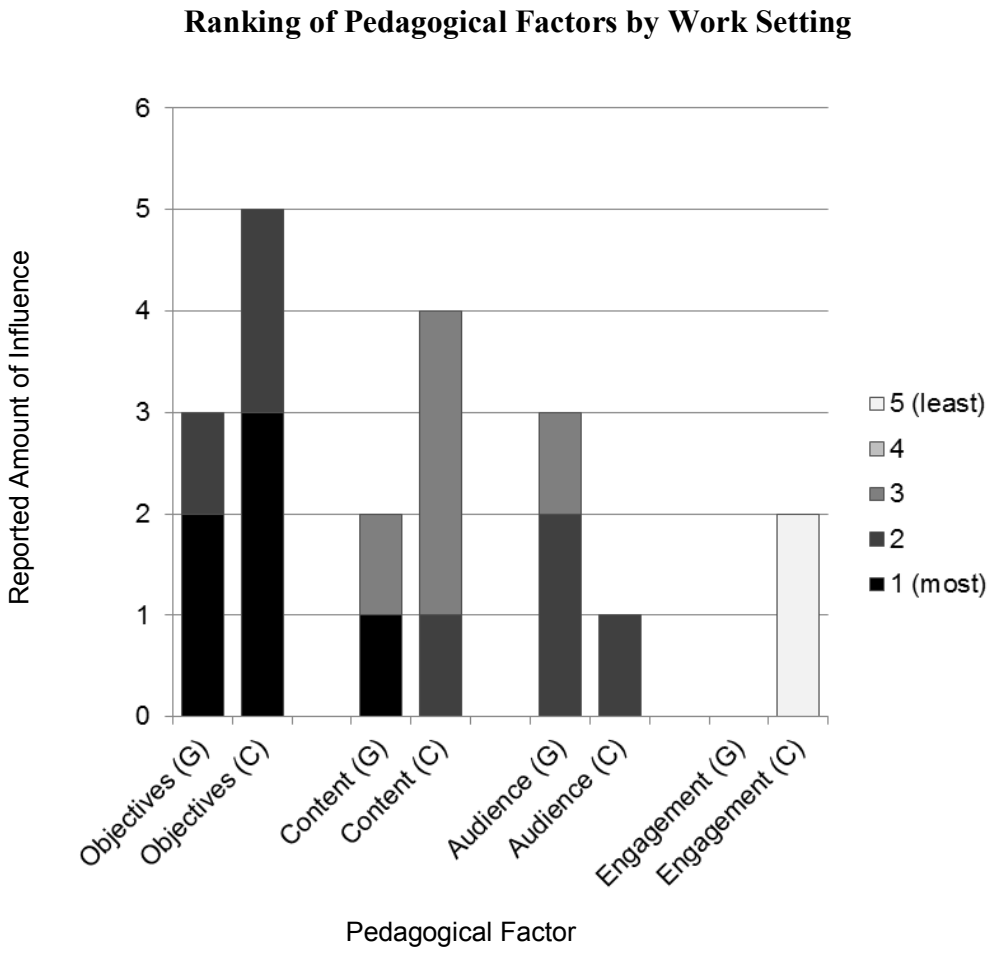

Figure 2. Ranking of pedagogical factors by work setting. C=Contractor, G= Government employee

Variations in Ranking of Production Factors by Work Setting

The production factors reported included budget, politics, resources, time, platform (authoring environment), and accessibility (Figure 3). There were major variations in factors and the ranking of those factors between the two work settings, contractor and government. Four of the six contractors ranked a production factor as the most influential with a ranking of 1. One of the four government employees ranked a production factor as their first factor; the factor was politics. Five of the 10 participants ranked budget as either their first, second, or third factor in terms of influence. Of those five, one participant was from the government setting and ranked budget as their second highest factor.

Ranking of Production Factors by Work Setting

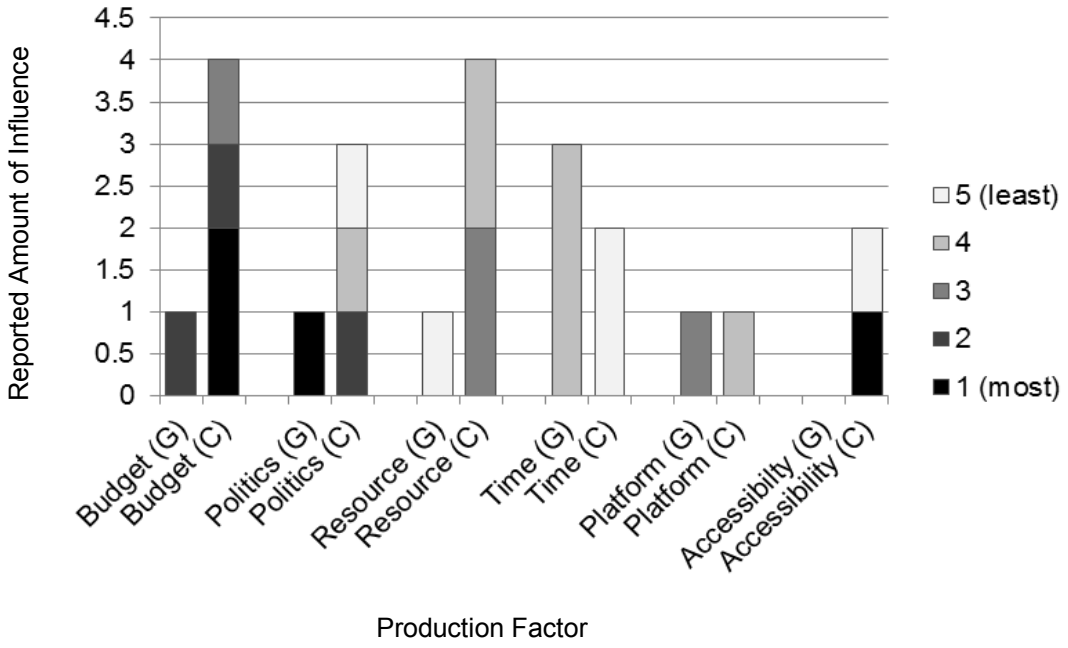

Figure 3. Ranking of production factors by work setting. C=Contractor, G= Government employee

"Tom", a contractor, stated that "It's a number of different factors, one of which is—and I'll be honest here, number one is the cost factor." "Jim" concurred, "as much as we hate to admit it, it [budget] does determine a lot of your choice." "Nell" would prefer to place the pedagogical factors above the production factors, but explained as a contractor it is the production factors, specifically budget, that are important. She described the situation as follows:

> The reality is most of these [e-learning projects] are budget driven. I would have to put that at the top of my list. The budget drives it. I would like to say it was the objectives that would drive it but I can't say that. Content, especially from a client's perspective, they want to get their content in there.

As an instructional designer, "Nell's" emphasis is on the learning objectives. But as a contractor, "Nell" recognizes that the learning objectives are not necessarily the emphasis of the client all the time, and stated that "If you go in there stomping your feet, you might be shown the door too quickly."

Limited Citing of Accessibility as a Factor

Two of the 10 participants listed accessibility as a factor. Both were from the contractor work setting. "Tom" ranked accessibility as a 5, the least in terms of influence. He stated that, "I would have to throw in, to some degree, accessibility." "Beth" ranked accessibility as a 1, the highest level of influence. When "Beth" is selecting instructional strategies her primary focus is on the desired performance goals and "what activity is going to best prepare them [the learner] for the action they have to take on the job." She explained that she has "to factor in accessibility more on some sort of interaction or

activity than I do on something that just presents content." When "Beth" is under contract to deliver a 508 compliant course, she emphasized that "then accessibility has to be my number one factor."

"Henry" did not list "accessibility" as a factor that influenced the selection of instructional strategies. However, he provided an example of when the accessibility requirement impacted the selection to the point where e-learning was no longer considered an option. In his government agency, the testing and clearance process for accessible e-learning requires several months. Therefore, when the e-learning product is needed quickly, he considers alternative modes of training rather than e-learning. When the requestor tells him "they've got a desperate need to get something out to their audience quickly, we may look at other alternative modes of doing it."

Ensuring E-Learning is Accessible

The third research question was "How do instructional designers ensure an instructional strategy will not compromise the accessibility of e-learning?" Data collected to address this question consisted of participants' responses to five interview questions and artifacts provided by participants (questions 6, 7, 8, 10, and 11). Participants were asked about the approaches and guidelines their organization has to support the creation of accessible e-learning. Participants were asked if they had encountered accessibility challenges and if so, how they resolved the challenges.

Data analysis resulted in the following four themes addressing the issue of ensuring e-learning accessibility: checklists used to ensure accessibility, input of assistive technology users, alternative versions of the e-learning, and custom developed tools and

templates. Participants' responses to the questions included references to their standard work practices. The work practices applicable to accessible e-learning are listed in Appendix C.

Checklists Used to Ensure Accessibility

When participants were asked what approach or policy their organization has adopted to support the creation of accessible e-learning, nine of the 10 participants reported the use of checklists. Of those nine who use checklists to ensure accessibility, six relied on official Section 508 checklists issued at the government agency level and three followed their company's checklists. One participant, "Tom", stated his organization had no written policy and did not use a checklist because accessibility is integral to his "mission". He developed an accessible framework upon which all of his e-learning is built that negates the need for a checklist.

An excerpt of a checklist based on the official Section 508 checklist is shown in Figure 4. This checklist provided from "Jean", a government employee, includes 66 check point items. For each checkpoint there is a space for the Project Manager and 508 Compliance Officer to check Yes, No, or NA and to insert comments. Completion of the checklist requires signatures from both the Project Manager and 508 Compliance Officer.

Example of a Section 508 Checklist

[redacted]

Section 508 Checklist for Functional Performance Criteria

Below is the functional checklist for all Electronic and Information Technology (including software, web applications, web pages, and electronic documents) and the best practices recommended for fulfilling these Section 508 requirements. These checkpoints are to be used in conjunction with other checklists, such as 1194.21 (Software Applications) and 1194.22 (Web-based Information and Applications).

For questions or assistance completing this document, contact your [redacted]

Application Name/Version#	Project Manager Name/Signature	508 Compliance Name/Signature	Date

1194.31	Checkpoint	Yes	No	N/A	Comments
(a)	**At least one mode of operation and information retrieval that does not require user vision shall be provided, or support for assistive technology used by people who are blind or visually impaired shall be provided.**				
a.1	Are links and active elements worded in such a way that they can be used with screen reading technology?	*	*	*	
a.1.a	For links and active elements, is different text used for different targets or functions?	*	*	*	
a.1.b	Is text for links and active elements, meaningful both in and out of context?	*	*	*	
a.2	Are tables coded in such a way that they make sense to a user of screen reading technology?	*	*	*	
a.2.a	Are nested data tables avoided?	*	*	*	

Figure 4. Example of a section 508 checklist. Excerpt of a government agency's official Section 508 checklist.
Source: Example of a Section 508 Checklist courtesy of Participant "Jean". (Used with permission).

"Ann", a contractor, provided the e-learning development guide used by a federal agency to establish specifications and standards for the design and development of the agency's e-learning. The agency's guide states that "All e-learning assets developed using standard commercial tools to produce courseware files acceptable to [the agency] must be demonstrably Section 508 compliant." The guide includes references to Section 508 compliance throughout. For example, within the section with specifications for audio, the guide states the following:

> Audio files can be used to add emphasis and clarity to content presentation when appropriate. Audio use must conform to Section 508 compliance specifications. This includes providing written text for each audio component that students can access from the same screen on which the audio element is housed.

The guide includes a section titled Accessibility Guidelines which specifies the minimum requirements for ensuring 508 compliance and communicates the agency's policy in regards to curtailing the use of print-based alternatives. An excerpt of a draft version of this section is shown in Figure 5. The guide places the responsibility of ensuring compliance "in accordance with Section 508" on the e-learning developer and lists specific techniques the developer can use to demonstrate compliance.

Accessibility Guidelines Within an E-Learning Development Guide

8.2 Accessibility Guidelines

The Rehabilitation Act Amendments passed in 1998 defined Section 508 to eliminate barriers in information technology by making electronic and information technology (E & IT) accessible. Section 508 requires that all E & IT developed, procured, maintained, or used by federal agencies, must be comparably accessible to users with disabilities. If achieving this goal places an undue burden on an agency, an alternative means of access must be provided for persons with disabilities to access the agency's information and data.

NOTE ON PRINTABLE VERSIONS: Printable version of elearning assets are frequently assumed to be sufficient to meet the letter and spirit of Section 508. In fact, unless a finding of undue burden has been made, sole reliance on printable options to satisfy the law is unacceptable. **Elearning assets may not rely solely on a print-based alternative to satisfy Section 508 requirements without express, prior, written consent from [redacted].**

All elearning assets must incorporate Section 508 guidelines into the design and development process. At a minimum, the following requirements must be met:

1. Visual elements are appropriately described through ALT tags or D-links. (See Section 5.4)
2. All screen elements have a designated tab order that allows for meaningful "within page" navigation that does not require use of a mouse and that lead a screen reader through the text appropriately.
3. Where necessary, alternative pages may be programmed to allow for comparable learning experiences (for example, providing a series of fill in the blank questions as an alternative to a drag/drop exercise).
4. Screen text and color choices provide good contrast, clarity, and readability. (See Section 5.6)
5. Audio and video files are supported with the appropriate controls and are aligned with accessible text. (See Section 5.7)

. . .

GUIDANCE: Section 508 compliance can be demonstrated through such tools as JAWS, through the verification services of commercial compliance software, and through the implementation of a rigorous quality assurance/quality control process that verifies the design and development attributes of the asset in accordance with Section 508 paragraphs (a) through (p).

DRAFT

Figure 5. Accessibility guidelines within an e-learning development guide. Excerpt of a government agency's guidelines which specify the minimum requirements for 508 compliance and the policy for curtailing the use of print-based alternatives.
Source: Accessibility Guidelines Within an E-Learning Development Guide courtesy of Participant "Ann". (Used with permission).

"Henry" was the only participant who stated that their agency required two levels of review, one at his office level using a checklist and the other at the agency level. The official agency review is very stringent and can take up to 8 months to complete. "Henry" described as follows:

> We have a mandate that all of our e-learning products and other products would be 508 conformant, and it is to the point of we have delivery truck training that has been determined has to be 508 conformant, even though people with hearing or visual imparities cannot get C class drivers licenses to drive delivery vehicles. We could not get an exception because we were told they may have a supervisor or someone else that needs to understand what their drivers know.

Input of Assistive Technology Users

To ensure e-learning is accessible, six of the 10 participants reported seeking input of individuals who routinely use assistive technology. When "Mike" first created accessible e-learning he sought informal feedback from disabled individuals who used assistive technology. He explained, "If they're having a hard time reviewing the module, it gets filtered back to us and we will make changes, make corrections and do what we have to do to make it accessible for them."

"Jim" described an e-learning project with a target audience that included a "higher than normal percentage of visually impaired." For this project, his company hired a consultant who was visually impaired to help them "work through that project" and keep it "on base." The consultant "listed some great insights that we still use to this day about how she accessed information and how she preferred information to be presented or accessible."

"Lisa" shared that she occasionally relied on the input of an individual within her company that uses a screen reader daily. When an accessibility challenge is encountered, "Lisa" stated that "we'll send it over to him and say can you tell us how this looks to you. When you pull this up on your screen reader, what does it look like?"

"Pam" described the need of input of assistive technology users from the formative evaluation standpoint. She explained that to test her e-learning, she does the following:

> I have a couple of buddies with low and no vision to scrutinize them [the e-learning], because I think when you're working on a project, regardless of your education experience, years in the business, you have tunnel vision, and you really need to have an entire team of people evaluating it and not just one or two.

"Henry" realized the value of input from assistive technology users but his agency does not allow him to receive their input. He described the impasse as follows:

> I've asked them, give me access to the 508 audience, I would love to create targeted training specifically for them; it would help us all because we would understand that audience better how to deal with them, what strategies work for them better, but that's a disadvantage, I think, probably throughout the federal sector is because of privacy standards and those kinds of things. We don't have access to that audience.

In his discussions with colleagues in other agencies, "Henry" has learned that "consistently the answer we get from the 508 audience is 'give us text.' 'We've learned to learn best by text. Give us text.' "

Alternative Versions of the E-Learning

Four of the participants reported the use of alternative versions to ensure compliance with Section 508. There were two types of alternative versions reported, one that resulted in dual end-products and the other that resulted in one end-product

containing alternative paths. For the dual end-product approach, there would be an alternative version of the content created with basically the same content as the regular e-learning. “Jean” explained the dilemma as follows: “Accessibility has been a huge problem because there are some cases where it’s just not possible to give the same experience and so we’ve created essentially two different courses.”

The key to the second type of alternative approach was that the alternative paths were triggered by the use of assistive technology or by the learner. For example, at the point in the e-learning where there is a non-accessible interactive segment, if assistive technology is in use the e-learning path would go to an accessible multiple choice question. “Beth” explained that this alternative path approach was common and noted that “one feels like a multiple choice question, one feels like this really cool, fun interactivity that I get to click around and play with. So one is accessible, the other is not.”

“Henry” shared an example of when he created this type of alternative version. The version for learners with disabilities provided a “different activity designed specifically for 508 users” and “the instructional strategy is slightly different but the content is exactly the same.” He explained he is “pretty stringent about not sacrificing instructional integrity for the masses in order to meet the needs of the accessibility audience.”

"Tom" shared that he had heard uninformed vendors refer to alternative versions as "a dumb downed version for the blind people." He does not approve of alternative versions. In his ongoing research of e-learning Tom continued to see poorly designed e-learning and noted, "I still see a heck of a lot of alternative versions created for those with disabilities and, frankly, that drives me nuts and I don't like that."

Custom-Developed Tools and Templates

Three of the 10 participants relied on their custom-developed tools and templates for the creation of accessible e-learning. "Henry" was concerned with the instructional integrity of his agency's e-learning, so he created a series of "instructional strategy templates which have been made to be 508 conformant." The e-learning he creates with these templates is still required to undergo the agency's stringent 508 review, but "they're a little more lax on it because they know that the template generally produces 508 conformant content so they just spot check here and there and let it go through."

To ensure people with disabilities have equal access to content "Ann" created an assistive technology tool that enables those with disabilities to access e-learning without need for changes to the e-learning files. Her proprietary tool is intended to be used in conjunction with e-learning created with HTML 5 or Java Script. To use the tool the designer creates the instructions the learner will need to navigate through the e-learning. The custom instructions direct every possible learner action and specify the corresponding keystroke or voice command the learner can use to navigate the e-learning. The learner does not need a screen reader.

In 2003, "Tom" began studying the options available for creating 508 compliant e-learning and realized "that there was no good way to develop accessible e-learning."

“Tom” explained that learners with disabilities had to endure poorly designed e-learning such as a 15-minute course that took “a blind person an hour and a half to go through” because the disabled learner had to repeatedly listen to the screen reader repeat the entire “table of contents every time they [the learner] hit the ‘next’ button.”

As an entrepreneur, “Tom” realized a need for an improved approach to create accessible e-learning so he developed an e-learning course framework that contained every possible combination of content presentation techniques and assessment techniques. He sent the framework to an individual who provides “field approval for 508 validation” because he planned to “build lots of courses, hundreds and hundreds of courses that have assessment questions and media links. . . . So if you approve my framework, then I know all the courses built with my framework will be accessible.” Using this framework as the foundation has dramatically simplified the creation of accessible e-learning for “Tom’s” company.

Perceived Impact of Accessibility

The fourth and final research question was “How do instructional designers perceive and describe the impact of accessibility requirements on the selection of instructional strategies?” Data collected to address this question consisted of participants’ responses to three interview questions (questions 12, 13, and 14).

After hearing the definition for each of the three degrees of accessibility recited by the researcher, participants were asked which degree(s) of e-learning they had created. Participants were asked “what impact, if any, have accessibility requirements had on your approach to the selection of instructional strategies?” Participants were asked how their

instructional strategy selection would be impacted if there were no legal or policy requirements enforcing accessible e-learning. The following three themes emerged from the data: goal is universal design, custom design of e-learning for learners with disabilities, and viewpoint that accessible e-learning is the "right thing to do." Excerpts of participants' comments supporting these themes about the reported impact of accessibility are shown in Appendix D.

Goal is Universal Design

The three possible degrees of accessible e-learning are universal design (Degree 1), accessible design (Degree 2), and accommodate (Degree 3) (M. Urban, personal communication, February 4, 2010). The researcher recited the definition for each of the three degrees then asked each participant which of the degrees they had created. The results are shown in Table 12.

Table 12. Frequency of Degrees of Accessible E-Learning Reported by Participants ($N = 10$)

Degree of accessibility	Participants	Frequency	%
Degree 1: Universal design	Ann, Beth, Henry, Jean, Jim, Lisa, Pam, Tom	8	50.0
Degree 2: Accessible design	Ann, Henry, Jim, Mike, Nell	5	31.2
Degree 3: Accommodate	Ann, Beth, Henry	3	18.8

Eight of the 10 participants listed the first degree, universal design, as a degree they create. Two of the participants reported only working with the second degree, accessible design. Two of the participants, reported creating e-learning for all three degrees. “Henry” aims for universal design, but admitted his agency often ends up creating Degree 2 or Degree 3. For “Pam”, the third degree, accommodate, is not an acceptable option. She relays her sentiments as follows:

> Accommodation is a dirty word to me. I really do not like accommodations. . . . I would say at [her government agency] we strive for the universal, not just what someone using accessibility equipment would use, but we're seeking to provide something that is going to be enjoyable and usable for everyone.

“Beth’s” reported doing both Degree 1 and Degree 3 depending upon the needs of the customer. She had observed other instructional designers who see Section 508 compliance as an obstacle. Her response to those designers was, “you guys have got it all backwards here. If you design things well, you’re going to reach a very broad audience and that includes people who are using assistive technology.”

Custom Design of E-Learning for Learners With Disabilities

Six of the 10 participants were adamant in the delivery of their sentiments that e-learning that meets Section 508 requirements is not necessarily an effective learning experience for learners with disabilities. A resolution posed by the participants was to custom design e-learning specifically for learners with disabilities. “Beth” shared that “there are certain things we could get away . . . and still be 508 compliant but it wouldn’t really be friendly.” “Ann” illustrated how making a drag and drop activity accessible made the learning experience awkward for the learner who relies on assistive technology through the following example:

> We provided detailed instructions on the screen for the person using screen reading technology how to do it. But it was just so cumbersome for the end user that it just—yeah, we made it happen but at what cost, you know?

"Tom" described specifics about courses he had seen that were technically 508-compliant but were frustrating for the learner using assistive technology. "Tom" shared the following example:

> They had people creating courses and would take a blind person an hour and a half to go through a 15 minute course. Why? Because they had to listen to the whole freaking table of contents every time they hit the "next" button. And then they had to hit tab 15 different times to get to the next button because it always puts them back outside the browser or the address bar or something lame like that. So they're either stuck with that or they get stuck with the stupid PDF version of a course. . . . Everyone else has engaging this and that and audio and video to watch and they give the disabled person a PDF version. I'm like, that's not right.

"Jim" realized the need to create a version of the e-learning "that communicates the same content but maybe in a more accessible way" for the learner with disabilities. "Jim" created an accessible e-learning that passed every checklist he had. He had considered the needs of learners who are visually impaired, hearing impaired, and "who have fine motor skill issues." When "Jim's" "universal designed" e-learning was reviewed by the assistive technology user reviewer, "Jim" learned the following:

> This is really great but it would be more meaningful to me [assistive technology reviewer] if I didn't have to listen to all this skip navigations and image alt text'. He goes, 'if you could just present me with headers in the content, that's really all I need; all the other stuff is just extraneous.' And I thought, well, here's an example of we had really worked to make this training accessible to everyone; one training that did everything. And in that case he was saying, 'yeah it sort of works but you could have just given me a slightly different version and it would have worked even better for me'.

"Beth" realized that her standard practice of e-learning design "lumps all accessibility students into one category" making the end-product not optimal for all. She explained as follows:

> The person who's using a screen reader wouldn't want it to auto start, and the person who is hearing impaired doesn't need the audio to ever start. But what about the person who can't use a mouse? Well, they don't mind if the audio auto starts; in fact, they probably prefer it. . . . So lumping all three of your accessibility categories into one set of preferences I don't think is really appropriate, and that just kind of was a light bulb that went over my head recently is it's not one size fits all.

"Henry's" version of the ideal world is for instructional designers to be trusted to create the optimal learning experience for all learners. He equated the role of the instructional designer to that of a clinician, as follows:

> We are kind of clinicians because we look at people and we diagnose instructional problems and we prescribe instructional solutions. And maybe they could give us some kind of a right, client privilege, you know, or patient-doctor privilege or something so that we could look at these people, they could trust us to design things that would ultimately work best for them and their audience and do that.

In "Jean's" work with visually impaired she learned that for e-learning visually impaired learners want text. She advocated that instructional designers be allowed "to create the best experience for those without the accessibility needs and give the accessible individuals what they really want anyway." "Jean's" summation of the situation is that the instructional design community is still "in the infancy for accessibility and that we're trying to serve the world basically without really fessing up and realizing what is best [for learners with disabilities]."

Viewpoint that Accessibility is "Right Thing To Do"

Participants were asked how their instructional strategy selection would be impacted if there were no legal or policy requirements enforcing accessible e-learning. The results are shown in Table 13. Seven of the 10 participants shared that the absence of a legal requirement would have no impact on their instructional design practice. For example, "Mike's" reply was "It wouldn't change at all. I mean if anything we would be even more [sic] trying to make our modules even more accessible." "Jean" envisioned that not having the legal requirement would "free us up to be able to create the best experience for those without the accessibility needs and give the accessible individuals what they really want anyway."

Table 13. Change in Practice if No Legal Requirement Enforcing Accessibility (*N* = 10)

Impact if no law	Participants	Frequency	%
Would still create accessible e-learning and universal design	Ann, Henry, Jean, Jim, Mike, Pam, Tom	7	70%
Would not create accessible e-learning	Beth, Lisa, Nell	3	30%

Three of the participants shared that the absence of a legal requirement would enable more creativity. "Lisa" felt that no legal requirement would mean that the "creative team would have more leeway". "Nell" agreed and stated that the e-learning design would "vary a lot more". "Beth" saw the absence of the law as an opportunity to create the "optimum" learning experience for the majority of the learners. She would

determine how likely it is that the audience will require accessible e-learning and advise her clients based on that likelihood. She conjectured the following:

> If the likelihood of them [the client] having someone with accessibility concerns take the course, if that likelihood is so very low, I would rather create the optimum performance of the course than the optimum engagement and the optimum retention for the 99.99% of the audience who does not have accessibility concerns.

Five of the 10 participants were impassioned in the delivery of their opinion that creating e-learning that is user-friendly for all learners with disabilities is "the right thing to do." "Jim's" rationale for why universal design is a "good thing to do" boils down to the fact that he sees our job as instructional designers is to give learners "the content they need." "Jim" emphasized his point as follows:

> That's really what training is all about, is to get the information to the people and they've got to be able to read it, see it, hear it, however they absorb that information. That's just what you do, you know? You're not doing your job otherwise.

When describing her company's process for creating e-learning, "Beth" shared the following:

> There's [sic] so many ways to interpret the [508] standards, execute the standards, and we felt as a company we didn't really understand it well. And we wanted to make sure we were executing properly for a number of reasons. Number one, it's the right thing to do. If you're going to be accessible, do it right, don't just do it by the letter of the law, do it right. Make it effective also.

When "Tom" was contemplating his company approach to e-learning he had two perspectives, business and human. He realized that making an e-learning framework that was 100% accessible was a smart business decision and at the same time "there's my human side with my human hat on, it's just the right thing to do." To communicate the

import of accessibility to potential clients, “Tom” uses the following analogy:

> When they first passed the ADA Act and you had buildings and that kind of stuff to make them accessible, you would bolt on these rickety old wheel chair ramps that would wrap around the building and it didn’t really look right, you know, rusting and aagh. But over time literally building design and architects, now you can go places you didn’t even realize they are handicap accessible. There are ramps instead of stairs and it’s designed into the building and I think where we are in e-learning is we’re still back in the 1940s. . . . So in Tom’s world what we see is that e-learning is still back in the old days and until people start seeing and realizing, yes, you can build a building that is handicapped accessible that doesn’t look like a monstrosity or an afterthought or a bunch of stuff bolted onto the outside. So our mission is to raise that bar and show people that you can do it.

Summary

This chapter provided the results of the study, with emphasis on presenting the results in the words of the participants in accordance with the qualitative approach of the multiple case study methodology. The 10 participants in the study represented a cross-section of instructional designers in terms of demographics and e-learning design experience. The results were presented for each of the four research questions. This chapter also produced a list of design work practices for accessible e-learning which are listed in Appendix C. The work practices originated from the 10 experienced designers who participated in this study and by the five Section 508 Coordinators who recommended study participants. Excerpts of artifacts are shared as applicable throughout the chapter and in Appendix E.

When asked what instructional strategies they select for accessible e-learning, participants listed 10 strategies that work and three strategies that do not work. Five of the 10 participants reported that a virtual world or simulation type instructional strategy would not be accessible. In studying the process used and factors that influence

instructional strategy selection for accessible e-learning, participants consistently cited pedagogical factors as having the most influence. However, there were variations among the two work settings, government and contractor, in the degree of influence assigned to production factors. The production factor of budget was cited as more influential among contractors.

The primary techniques shared by participants for ensuring e-learning is accessible included the use of checklists, getting input from assistive technology users, creating alternative versions of the e-learning, and developing custom tools and templates. Eight of the participants reported that they create e-learning with the goal of universal design. Six of the participants emphasized the need to create e-learning specifically for the learners with disabilities rather than just making the e-learning comply with the Section 508 requirements. They were concerned that just meeting Section 508 requirements was not necessarily providing an effective learning experience for learners with disabilities. This sentiment was shared by five of the 10 participants who emphasized that creating e-learning that is user friendly for all learners with disabilities is "the right thing to do."

The researcher's interpretation of the findings for each research question is presented in chapter 5. By coalescing her knowledge of relevant literature and studies, in-depth familiarity with the findings of this study, and personal views and experience, the researcher presents a determination of the impact of accessibility requirements on the selection of instructional strategies for e-learning.

CHAPTER 5. DISCUSSION

Introduction

This research study was framed by a "how" question, "How do accessibility requirements influence the selection of instructional strategies?" The results of this study form an important first step towards the establishment of best practices and guidelines for the design of accessible e-learning. The researcher conducted a multiple case study to explore the perceptions and describe the practices of expert instructional designers in the selection of instructional strategies for accessible e-learning.

The core research questions for the study are set in the context of self-paced e-learning procured, used, or developed by U.S. federal government and include the following:

1. When designing accessible e-learning, what instructional strategies do instructional designers select?

2. What processes do instructional designers apply when selecting instructional strategies for accessible e-learning?

3. How do instructional designers ensure an instructional strategy will not compromise the accessibility of e-learning?

4. How do instructional designers perceive and describe the impacts of accessibility requirements on the selection of instructional strategies?

To ensure sufficient data would be collected to answer the core research questions, sampling was approached in an iterative process. The goal was to reach a sample size that supported the achievement of conceptual saturation (Sandelowski, 1995)

and identify information-rich individuals who would provide credible data to answer the core research questions. Study participants represented a subset of instructional designers employed by government agencies or by commercial companies with expertise in the creation of e-learning required to be Section 508 compliant. The researcher contacted 32 Section 508 Coordinators from federal agencies and requested recommendations for prospective participants who design 508-compliant e-learning either employed by the agency or a commercial company providing instructional design services to the agency. A purposeful sample of 10 instructional designers was identified based on the following selection criteria: (a) 10 years of experience (Fadde, 2009) designing e-learning, including experience before and after the implementation of Section 508; (b) committed to understanding the nature and meaning of accessible e-learning; and (c) willingness to participate in a lengthy phone interview and possible follow-up phone interview.

The 10 participants represented a cross-section of instructional designers within the context of self-paced e-learning procured, used, or developed by U.S. federal government in terms of demographics data and work setting data. The number of years of experience ranged from 10 years to 30 years with a total of 181 years and a median of 15.5 years. The e-learning design experience of the participants represented a balanced variety in terms of the type of content and type of learning addressed.

The four elements of data collection for this study included interviews, member checking, artifact collection, and the researcher's journal. Interviews were conducted by phone using deep questioning in a semi-structured approach (Hatch, 2002). The interview consisted of a sequential list of open-ended questions which stemmed from the core research questions.

The goal of this chapter is to explain the phenomenon of instructional strategy selection for accessible e-learning and to take the reader inside the issues and context of the study (Hatch, 2002). A summary and discussion of the results for each of the four research question is presented in the next section. The remaining sections of this chapter address the limitations, clarify assumptions, provide recommendations for practice and future research, and present the researcher's conclusions.

Results

When Designing Accessible E-Learning What Instructional Strategies do Instructional Designers Select?

Study participants were asked to list the instructional strategies that work and do not work for accessible e-learning. Instructional strategies were defined as techniques and methods used to relay content to learners in support of the learning objectives. Participants identified the following 10 instructional strategies that work for accessible e-learning:

- Scenario
- Multiple choice question
- Quiz and assessment
- Animation
- Voice-over narration
- Graphics
- Video
- Text
- Matching question
- Drag and drop question or activity

Seven of the 10 participants listed scenarios as a strategy they use in accessible e-learning. Quizzes and assessments such as multiple choice questions were also listed as instructional strategies that work. Five of the 10 participants identified animation as an instructional strategy choice. One of those five participants specified Adobe Flash as an acceptable tool for creating accessible animation.

Participants identified the following three instructional strategies as strategies that do not work for accessible e-learning:

- Virtual world/simulation with both visual and dragging action
- Adobe Flash animation
- Drag and drop activity

Two of the participants reported that there were no instructional strategies that created accessibility concerns. Two instructional strategies, Adobe Flash animation and drag and drop activity, were each cited as strategies that work and as strategies that did not work for accessible e-learning. Three participants reported animation created with Flash as not being 508 compliant. Three other participants reported that Flash animation can be made compliant. One participant provided draft documentation of her company's internal processes for creating accessible Flash for e-learning.

The discrepancy with whether a specific tool such as Flash is accessible or not may stem from the technology-neutral approach adopted by the World Wide Web Consortium (W3C) in communicating guidelines. In 2008, W3C released new accessibility guidelines for designers to apply broadly (W3C, 2008). The Web Content Accessibility Guidelines (WCAG) 2.0 are principle-centered guidelines that do not

specify the tools or techniques that are acceptable. The successful use of Flash within accessible e-learning is dependent upon the technical steps and standard practices employed by the designer.

There were also discrepancies as to whether drag and drop activities are accessible. Two participants listed drag and drop as an instructional strategy that cannot be made accessible and two listed it as a strategy that is accessible. Simple drag and drop activities can be made accessible when the action required of the learner can be communicated successfully through assistive technology. However, when the learner is required to perceive a visual message and react through a specific motion action, achieving accessibility for this more complex drag and drop activity is a challenge and often impractical.

Buzzard (2002) reported similar conclusions with her work in designing accessible e-learning. She stated that no compromises were needed in terms of the richness of media and interactions but she acknowledged that it was not practical to make visual identification exercises such as click and drag or matching accessible. Buzzard's findings from 2002 were echoed by the participants in this study. To learn more about what influences the design of accessible e-learning, the researcher studied the instructional strategy selection process.

What Processes do Instructional Designers Apply When Selecting Instructional Strategies for Accessible E-Learning?

To study instructional designers' processes for selecting instructional strategies for accessible e-learning, participants were asked to describe the process they use to choose instructional strategies and to list the factors that influence those choices in order

from most influential to the least. No participant delineated a process specifically for selecting instructional strategies for accessible e-learning. Six of the 10 responses to the question about instructional strategy selection process focused on influential factors; five focused on the significance of performance goal and one stressed the import of budget.

To determine what influences designers' decisions during the instructional strategy selection process, participants were asked to list the factors that influence their choices for instructional strategies in order of priority, from most influential to least. The researcher divided the reported factors into two sets, pedagogical and production. The pedagogical factors cited by participants in order from most influential to least were as follows: (a) learning objectives, (b) content, (c) target audience, and (d) engagement. The top three pedagogical factors, learning objectives, content, and target audience, received high rankings from all participants. The production factors cited by participants in order from most influential to least were as follows: (a) budget, (b) politics, (c) resources, (d) time, (e) platform (authoring environment), and (f) accessibility.

The findings of this research study were consistent with the literature directing instructional designers to consider pedagogical factors such as the characteristics of the content and the learners when selecting instructional strategies (Dick et al., 2005; Jolliffe et al., 2001; Morrison et al., 2004). The results of this study show that among the 10 participants from both the government and corporate work settings, the pedagogical factors consistently received high rankings. Eight of 10 participants ranked learning objectives as having a high degree of influence with a "1" or "2". However, there were noticeable variations in production factors between the work settings.

Wood (2002) found that in the academic setting, instructional strategy selection is influenced by pedagogical factors such as the educators' beliefs for education, more than by concerns with technology. While in the corporate setting, Stewart and Waight (2008) found that instructional strategy selection is influenced by production-related factors such as time, technology, and human resources. For this research study, the researcher found that participants from the contractor work setting tended to cite production factors more often than participants from the government work setting. Of all the production factors, budget received the highest ranking. Five of the 10 participants ranked budget as their first, second, or third factor in terms of influence. The contractors stressed the influence of budget and admitted there were instances when budget drove their choices.

The researcher anticipated that the factor of accessibility would be listed by participants as having a high degree of influence in the process of selecting instructional strategies for accessible e-learning. In Bel and Bradburn's (2008a) study within higher education setting, results had shown that the teachers were not implementing pedagogically sound lesson designs because they were concerned that the designs would not be accessible. Kelly et al. (2004) cautioned e-learning designers in the higher educational community that too much focus on accessibility requirements could have a detrimental effect on the pedagogic purpose of e-learning. They encouraged academic staff to find the "balance between accessible formats and reasonable adjustment" (Kelly et al., 2004, p. 10).

In Bel and Bradburn's survey (2008a) with 70 teaching staff in higher education setting, they found that teachers were not implementing pedagogically sound lesson designs due to concerns with accessibility. For this study within the government and

corporate work settings, accessibility was listed by only two of the 10 participants as an influential factor. One contractor ranked accessibility as having the highest degree of influence with a "1" and the other contractor ranked it as having the least influence with a "5". For those eight participants who did not list accessibility as a factor, the study results indicated that those designers had accepted the requirement of accessibility as a given and in some cases had incorporated accessibility into their work practices.

To address the accessibility concerns found in their study, Bel and Bradburn (2008a) prescribed that teachers needed guidance in order to move beyond their focus on adhering to web standards and towards adopting a pedagogical perspective of accessibility. By incorporating and accepting accessibility the participants in this study from the government and corporate work setting have followed Bel and Bradburn's prescription and have moved beyond focusing primarily on adhering to web standards and toward adopting a pedagogical perspective of accessibility.

An unanticipated pedagogical factor reported by two contractors was learner engagement. Participants acknowledged that in some cases it is difficult to design engaging e-learning when the content does not readily support interactivity or creativity. From the contractors' perspective the e-learning they create must engage the learner and incorporate meaningful interactions in order for the business to be successful.

Petrie et al. (2004) studied a cross-section of 1,000 websites and confirmed that accessible sites can have complex visual design and be visually appealing if web developers maintain a balance between accessibility and aesthetics. They recognized that some web developers believe that in order for a site to be accessible to users with disabilities, the site must be "uninteresting and simple, particularly visually

uninteresting—plain, vanilla sites" (Petrie et al., p. 13). These web development research findings supported Regan's (2004) contention that accessible sites do not have to be boring; he attributed the current inadequate state of accessibility to a "failure of imagination" (p. 30).

Participants in this study of accessible e-learning shared sentiments similar to the finding of these two web development research studies in that accessible e-learning does not have to be boring. Participants were determined to make e-learning accessible no matter what the development tool or instructional strategy choice. One participant linked success with accessibility to creativity and dedication to finding solutions rather than dwelling on what cannot be done. To learn more about how designers go about determining what can and cannot be done, the researcher asked participants how they ensured the accessibility of their e-learning.

How do Instructional Designers Ensure an Instructional Strategy Will Not Compromise the Accessibility of E-Learning?

When asked how they ensure an instructional strategy does not compromise the accessibility of the e-learning, all participants reported some degree of formal quality control in place to ensure compliance with Section 508 requirements. A variety of approaches to ensuring compliance were shared. Most of the participants, nine of the ten, reported the use of checklists. And of those nine, six relied on official Section 508 checklists issued at the government agency level.

The one participant not using a formal checklist had adopted a different approach; "Tom" took the entrepreneurial initiative to develop an accessible framework upon which to build e-learning. Because he invested resources into building and validating the

framework, he could be sure the e-learning built with this framework would be compliant. Two additional participants relied on custom-developed tools and templates for the creation of accessible e-learning. All three of these participants invested upfront time and resources to establish a foundation to ensure the systematic creation of accessible e-learning. Their approaches are consistent with Buzzard's (2004) sentiments of the importance of creating specific templates and tools to create accessible e-learning.

Six participants shared that one of the ways they ensure compliance is to evaluate the e-learning with users of assistive technology. One participant noted the importance of evaluating the e-learning with learners who use assistive technology, but his employer does not condone it. Participants conveyed that the insights gained from learners with disabilities who routinely use assistive technology was invaluable.

To ensure e-learning meets the minimum requirements to be in compliance with Section 508, use of a checklist will technically suffice. Henry (2006) discouraged website designers from relying solely on a checklist; to reach the "goal of accessibility is not to check off a guidelines list; the goal is to make your site accessible" (p. 29). To ensure e-learning offers all learners "equal access, equal use and equal effectiveness" (Buzzard, 2002, p. 2), requires some degree of evaluation with all learners including those with disabilities who routinely use assistive technology. Perceptions shared by the study participants offered clear distinction between e-learning that merely complies with the Section 508 requirements and e-learning designed to be equally accessible by all.

How do Instructional Designers Perceive and Describe the Impacts of Accessibility Requirements on the Selection of Instructional Strategies?

Since 2001 e-learning procured, used, or developed by U.S. federal government must comply with Section 508 requirements and thereby be accessible to people with disabilities (Learning Circuits, 2009). Pernice and Nielsen (2001) asserted that merely complying with Section 508 is not enough to truly support all learners as they stated in the following:

> As long as companies and government agencies view accessibility solely as a matter of complying with regulations and technical specifications, rather than a way to support the work practices and customer needs of people with disabilities, equal opportunity will remain a travesty.

Participants in this study do not approach accessibility "solely as a matter of complying with regulations and technical specifications" (Pernice & Nielsen, 2001). This conclusion stems from the responses given to the question of which degrees of accessible e-learning participants create. The three possible degrees of accessible e-learning are universal design (Degree 1), accessible design (Degree 2), and accommodate (Degree 3) (M. Urban, personal communication, February 4, 2010). Eight of the 10 participants listed the first degree, universal design, as a degree of accessible e-learning they create.

Study participants recognized that e-learning that meets Section 508 requirements does not necessarily support learners who rely on assistive technology, including learners who are visually impaired, hearing impaired, or physical impaired. Participants noted examples of e-learning that were awkward, cumbersome, and frustrating for learners using assistive technology. Six of the 10 participants advocated that designers be allowed to custom design e-learning specifically for learners with disabilities.

Pernice and Nielsen (2001) proclaimed that there are those who approach the matter of accessibility from a social justice perspective. Similarly, Mirabella et al. (2004) asserted that accessibility best practices should be supported fully because it is the "right thing to do" (p. 3). Based on the results of this study, five of the 10 participants are clearly driven by social justice to apply universal design principles to ensure maximum usage by all learners. Participants in this research study shared the sentiment that instructional designers should design accessible e-learning because it is "the right thing to do."

Limitations

Two limitations to consider for this study are the following: lack of a formal expertise assessment and response prompt included within interview instrument. The expertise of participants was not formally measured through a knowledge assessment or through validation that their e-learning complied with Section 508 requirements. The researcher assumed that participants were experts based on applying Fadde's (2009) theory of expert performance and based on participants' responses to the screening questions.

A limitation to consider is how the inclusion of instructional strategies examples within the Interview Guide (Appendix A) may have prompted specific responses from participants. Prior to asking participants to share the instructional strategies they use

within accessible e-learning, the researcher clarified what was meant by instructional strategy by providing the following explanation:

> Instructional strategies are the techniques and methods used to relay content to learners in support of the learning objectives. Some examples are voice-over narration, annotated diagram, interactive animation, scenario-based exercise, and assessment activity.

By hearing these examples as part of the interview script, participants may have been influenced to cite these strategies in their response.

Recommendations

Recommendations for Instructional Design Practice

In considering how the study results impact instructional design practice, the following three recommendations emerged: identify work practices to adopt, incorporate study results into organization guidelines, and allow pedagogical factors opportunity to influence instructional strategy selection. Within the literature reviewed for this research, no studies were located that addressed accessible e-learning design issues in a corporate or government setting. The results of this study offer instructional designers insight into the accessible e-learning design work practices of instructional design experts.

During the interviews, participants' responses included references to their standard work practices. The work practices applicable to accessible e-learning are listed in Appendix C. Readers should consider the listing of work practices and participants' quotes as a starting point for the compilation of accessible e-learning best practices and adopt applicable work practices. For example, if a current work practice is to rely solely on a checklist or automated tool to ensure compliance, readers should consider expanding

their focus beyond merely adhering to web standards and move toward applying universal design principles.

To follow the advice of Bel and Bradburn (2008a) and move beyond web guidelines and toward a pedagogical perspective of accessibility, readers can consider how the results of this study could inform their organization's e-learning guidelines. For those readers who need to specify acceptable instructional strategies, the listing of instructional strategies that work and do not work for accessible e-learning can serve as a starting point. To acknowledge the factors that influence the instructional strategy selection process, readers could consider addressing the pedagogical and production factors. Readers could contemplate how the factors shared by participants are valued within their own organization and how best to communicate the shared values within their organization's guidelines.

This study focused on the potential impact of Section 508 during the instructional design process of selecting instructional strategies for accessible e-learning. The findings of this research study were consistent with the literature which directed instructional designers to consider pedagogical factors such as the characteristics of the content and the learners when selecting instructional strategies (Dick et al., 2005; Jolliffe et al., 2001; Morrison et al., 2004). Participants consistently ranked pedagogical factors as the most influential.

However, the researcher found that participants also cited the production factor of budget as having a high degree of influence on instructional strategy selection. While budget is a critical and practical factor that must be considered in any work setting, designers are encouraged to fully consider all applicable pedagogical factors when

selecting the optimal instructional strategy for the e-learning. In those cases where the optimal strategy is not feasible due to accessibility or other production factors, instructional designers should explore alternative approaches to approximate the optimal strategy within production factor limitations.

In Bel and Bradburn's survey (2008a) with 70 teaching staff in higher education setting, they found that teachers were not implementing pedagogically-sound lesson designs due to concerns with accessibility. Results of this study within the government and corporate setting did not reveal the same high degree of concern with accessibility. Instructional designers are encouraged to apply the advice offered by Kelly et al. (2004) to not limit the pedagogic purpose of e-learning and to find a "balance between accessible formats and reasonable adjustment" (p. 10).

Recommendations for Future Research

The instructional design community is at a very early stage of understanding accessibility and what is best for learners especially those with disabilities. To continue improving the practice of instructional design of accessible e-learning, the researcher offers the following four recommendations for future research: study of e-learning with learners with disabilities, conduct this study in different context or setting, systematic review of award winning accessible e-learning, and study to clarify the universal design approach to accessible e-learning.

Participants conveyed that the insights gained from learners with disabilities who routinely use assistive technology was invaluable. A future study could identify instructional strategies that improve the e-learning for learners who routinely rely on assistive technology. A compilation of what is effective and ineffective for learners using

assistive technology could be used by the instructional design community to improve the accessibility of e-learning. A design methodology to consider is a Delphi study similar to that conducted by Robinson (2006) with visually impaired children in the K-12 educational setting.

The context for this multiple case study was limited to self-paced e-learning procured, used, or developed by U.S. federal government. Changing the context from self-paced e-learning to instructor-led virtual training would offer comparison data to evaluate the merits of each form of accessible e-learning. The Interview Guide (Appendix A) could be applied to a sample of instructional designers within higher education settings. The results would be directly applicable to the instructional design community within academic settings.

Regan (2004) reviewed the websites listed as winners of a Webby Award to gauge the current standing of accessibility versus design. His findings showed that only five of the 41 websites reviewed met all of the WCAG 1.0 guidelines. A comparable study of e-learning would provide insight into how instructional designers are balancing the challenge of accessibility with the need for engaging and interactive designs.

The literature review showed that there was a growing emphasis on the highest degree of accessibility, universal design. Likewise, results of this study showed that eight of the 10 participants listed universal design as their accessibility approach. The universal design approach to accessibility is defined as the ideal of applying best practices and standards to ensure optimal usage of a product by all persons, including those with disabilities. Future research is needed to specify the best practices employed by instructional designers to reach the universal design degree for e-learning.

Conclusion

Section 508 became an enforceable law in June 2001. The instructional design community is still in the early stages of perfecting how to design accessible e-learning that provides all learners those with disability and without, a comparable learning experience. Of all the themes identified in the results, the one that triggered the most fervent responses was the sentiment shared by six of the 10 participants that their 508-compliant e-learning did not provide a positive learning experience for learners with disabilities. These participants realized how difficult and frustrating their e-learning is for learners who rely on assistive technology to access the content.

An analogy shared by one of the experts was how in the early days of the Americans With Disabilities Act which required all buildings to be accessible, wheelchair ramps would be randomly appended to buildings. Today, designs for wheelchair access have evolved and are woven into the building architecture often increasing the aesthetic appeal. In time, the same evolution of accessibility best practices can be woven into e-learning. Through improvements in instructional design practice, enhanced development tools, and sophisticated assistive technology, the instructional design community will be able to provide all learners with comparable learning experiences.

How exactly do accessibility requirements influence the selection of instructional strategies? The results of this study offer valuable insights into the perceptions and practices of 10 instructional design experts with over 181 years of experience in e-learning design. But the answer to that question will vary from one e-learning project to the next and depend upon the ingenuity and resourcefulness of the instructional designer.

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APPENDIX A. INTERVIEW GUIDE

Opening
Hello, this is Nancy Gathany. Is this still a good time for you to meet? [If yes, proceed. If no, reschedule.]

Thank you for agreeing to participate in the study.

Do you have five minutes to discuss the research I am doing as a doctoral learner at Capella University? [If yes, proceed. If no, schedule time to return call]

Study Purpose
The purpose of the study is to determine the impact of accessibility requirements on the selection of instructional strategies for e-learning.

Selection Criteria
For this study, I will conduct phone interviews with instructional designers. With your permission, I will be recording our conversation. The conversation will be transcribed and all identifiers such as your name and organization will be removed from the transcript. Your identity will be kept anonymous and your responses are confidential. Do you have any questions before we proceed?

I have four questions to determine if your experiences with accessible e-learning meet the sample selection criteria. You can choose not to answer any of these questions. Are you ready to proceed with the questions?

[If yes, proceed] [If no, address concern]

1. How many years experience do you have as an instructional designer creating e-learning?
2. Are you or have you been employed by an organization required by law or enforced through policy to develop accessible e-learning?
3. Briefly describe your education and work experience as it relates to instructional design and e-learning.
4. Would you be willing to participate in a 90 minute interview by telephone scheduled at your convenience and perhaps a follow-up interview if needed for clarification that would last no more than 10 minutes?

[If prospect does not meet criteria] It was good to speak with you today. Thank you for your time. [End Call] [If prospect meets criteria proceed to Interview Questions]

Interview Questions
I have a series of questions to ask about your experiences as an instructional designer to help us learn more about the impact of accessibility requirements on the selection of

instructional strategies for e-learning. This interview should last less than 90 minutes. Do you have any questions before we proceed?

1. Please describe in general the types of e-learning you create in terms of type of content and learning goals.
2. Instructional strategies are the techniques and methods used to relay content to learners in support of the learning objectives. Some examples are voice-over narration, annotated diagram, interactive animation, scenario-based exercise, and assessment activity.

   What instructional strategies do you use within the accessible e-learning you create?
3. What documents can you share where you describe or illustrate the instructional strategies (e.g., design documents, storyboards, product examples, evaluation results, or other reports)?
4. What process do you use to choose instructional strategies?
5. What factors influence your choice for instructional strategies? Please list in order of priority, from most influential to the least.
6. What approach or policy has your organization adopted that supports the creation of accessible e-learning?
7. How do you ensure an instructional strategy will not compromise the accessibility of your e-learning?
8. What guidelines or job aids can you share with me?
9. What instructional strategy have you found create accessibility challenges?
10. When you encounter obstacles or challenges with an instructional strategy, what has happened; how to you deal with that?
11. Tell me about a time when you did not use an instructional strategy due to concerns with accessibility.
12. What impact, if any, have accessibility requirements had on your approach to the selection of instructional strategies?
13. E-learning has been described as having three degrees of accessibility.

    a. The first degree is universal design (the ideal of applying best practices and standards to ensure optimal usage of e-learning by all learners, including those with disabilities).
    b. The second degree is accessible (best practices of accessibility applied specifically to enhance learning for learners using assistive technology).
    c. The third degree is accommodate (used when you are unable to design e-learning that is accessible through assistive technology).

    Which degree(s) of e-learning have you created? Please describe your rationale for each.

14. If there were no legal or policy requirements enforcing accessible e-learning, how would that change the instructional strategies you select for e-learning?
15. Is there anything else you would like to say about your work with instructional strategies and accessible e-learning that we have not covered?

Closing

Thank you for answering my questions. If additional questions arise, I will contact you to set up a brief follow-up interview. I will be preparing a summary of this interview and will e-mail it to you for your review. If you have any questions, please contact me. My number is [insert].

Thank you very much for your time today. [End Call]

APPENDIX B. FOLLOW-UP QUESTION

[The following question was administered to participants through email.]

Please review the list below that describes three levels of e-learning complexity. What percentage of your accessible e-learning products fall into each level? For example, perhaps you create 50% at Level 1, 25% at Level 2 and 25% Level 3.

Level 1

- Linear structure where learner moves from page to page
- Learner has no control over sequence
- Content presented in static form similar to Microsoft® PowerPoint presentation and an assessment activity

Level 2

- Learner has some control over sequence and presentation of content
- Dynamic content presentation and concept reinforcement
- Learner has opportunity and flexibility to move through course in a manner suitable for the learner's specific needs.

Level 3

- Complex interactions and complex presentations influenced by the learner's decisions and the choices
- Learner is required to interact and make decisions
- Real-time interaction

Thank you again for your time. If you have any question, please contact me. My number is [insert].

APPENDIX C. REPORTED WORK PRACTICES

Source	Work Practice
508	Information Technology Acquisition Policy To ensure employees implement the requirements of Section 508 of the Rehabilitation Act, the agency strengthened its information technology acquisitions policy. The policy requires the use of the "Buy Accessible Wizard", a tool to facilitate compliance with the requirements of Section 508.
508	Perform Market Research Use the BuyAccessible Wizard (www.buyaccessible.gov), a web-based application that guides users through a process of gathering data and providing information about Electronic and Information Technology (EIT) and section 508 compliance. Tool is designed to assist in meeting Section 508 requirements, specifically, performing market research on the accessibility of electronic and information technology products.
508	Accessibility Best Practices Library CIO.gov is the website of the U.S. CIO (Chief Information Officer) and the Federal CIO Councils, serving as a central resource for information on Federal IT (information technology). The site includes the Accessibility Best Practices Library where experienced practitioners identify and share accessibility and Section 508-related policies, methods, and techniques.
Beth (C)	E-Learning Uncovered Blog This commercial site features tools and resources for rapid e-learning developers. The blog is a companion site for the E-Learning Uncovered book series and shares helpful documents. For example, the table titled Accessibility of Authoring Tools, offers a comparison of the major accessibility features of Captivate, Lectora, and Storyline.
Beth (C)	Dual Roles—Designer and Developer When the instructional designer wears both hats, that of designer and developer, the selection of instructional strategies for accessible e-learning can be done more efficiently. According to “Beth”, “when I think of it [an instructional strategy], I can think at that moment how would I make this happen; okay that’s how I do it, is all that accessible, yes, and done in 30 seconds.”
Beth (C)	Formal Policy for “Accommodation” Organizations should develop a formal policy with input from legal advisors on their approach for accommodation of learners with disabilities. “Beth” advised companies “to have a formal decision in place about what to do if you do have a student who needs this training and cannot access it.”

Source	Work Practice
Lisa (C)	Coordinate Conversion of 508 Compliant Files Use a systematic process to assess how much work will be needed to ensure materials such as PDFs can be made accessible. "Lisa's" organization has a process in which materials are assessed and categorized into levels of work from level one which is the most simple to convert and can be done instantly to level four. Level four is for materials that are so complicated that a "clear approach to making accessible is unknown; requires senior staff to analyze and determine how to make compliant; may require an exemption where it's not possible to make it compliant so create alternative version.
Lisa (C)	SharePoint to Communicate Process for Conversion of 508 Compliant Files All members of the team reference SharePoint to view the agreed upon 508 practices and policy and to track status of conversion tasks required for each project. The site includes a copy of the official agency section 508 report and links to compliance tools such as ACCVerify. The reports generated by the compliance tool are tracked on SharePoint.
Lisa (C)	Multiple Staff for Routine a 508 Conversion Tasks Staff check out and check in documents requiring conversion from the SharePoint project site. This enables multiple staff to work the conversion tasks in a coordinated manner. "Lisa" recommends avoiding staff having to work solely on routine 508 conversion tasks. Her concern is that "They're just gonna burn out. So they'll do a couple of files, put them up on the [SharePoint] site, check them back in."
ALL	E-learning Developments Tools Cited Lectora, Flash, Captivate, HTML 5, Java Script, CoursePower, Course Avenue, Windows Movie Maker
ALL	E-learning Accessibility Testing Tools and Assistive Technology Cited Optic Inspector, Window-Eyes, Jaws, Acrobat Pro, Common Look, ACCVerify
508	Web Accessibility Toolbars There are numerous accessible toolbars available, each has advantages and disadvantages. The JISC toolbar was developed by researchers at the University of Southampton and tends to be a bit simplistic, but runs on many platforms. The AIS toolbar works best with IE. While the WAVE toolbar works with FireFox. These toolbars should only be used for simple e-learning development. For more complicated e-learning "professional" tools should be purchases such as AccRepair.

Note. 508 = Section 508 Coordinator; C = Contractor, G = Government employee

APPENDIX D. REPORTED IMPACT OF ACCESSIBILITY ON INSTRUCTIONAL STRATEGY SELECTION

Source	Comment
Ann (C)	Well, if you had asked me this 7 or 8 years ago, I would say it probably impacted it a lot because technology wasn't nearly as advanced as it is today. . . . because I have the extensive knowledge that I have, it doesn't impact me very much at all.
Beth (C)	Because there's so many ways to interpret 508 when it comes to e-learning and because there's not much in the way of case law, we place our company at risk to say we're going to be 508 without knowing exactly how we're going to execute that. . . . So we set out on a project to formally document our processes and policies and also separate out what is required versus what's usable.
Henry (G)	I was actually told by leadership to dumb it down. Professionally, that hurt me. It was like, no, I can't do that and want to come into work. But I know a lot of others have, and not just our organization but other organizations, if they have to meet stringent 508 requirements, they create a page turner. Something that has really very, very low instructional integrity.
Jean (G)	I think that there is a lot more page turners.
Jim (C)	I guess the old adage time is money. That may not always be the case but certainly production time is one that I'm sort of cognizant of. And looking at how when you make choices, what is the impact on time.
Lisa (C)	I'd say it could impact it pretty heavily. I think we're better now at thinking about that. It's becoming more automatic. We used to go off and build it, go get creative and do whatever we want to do, and then 508 was an afterthought. . . . now what we do, it's kind of right up there in the beginning as we're thinking about strategies, we're going, okay, that sounds good and then how would we handle 508 for this?.
Mike (G)	Accessibility adds development steps like alt-tags but no impact on design steps.
Nell (C)	As time goes on less and less. I just find the technology is—can handle it now much more than when they first started pushing this.
Pam (G)	So I would have to say yes, video was put on ice for decades. And it's really—the technical portion of 508 is easy, it's convincing people that you have to do it, that's what's difficult.
Tom (C)	In some respects I could say its [accessibility] 100% factor because we went back and retooled everything to make it accessible. . . . It affected every element of our instructional design and because we kind of I think we solved the problem moving forward, its 10% factor, 15% factor. . . . because we invested what we did, it's a small percent now.

Note. C = Contractor, G = Government employee

APPENDIX E. ARTIFACTS RELATED TO ACCCESSIBLE E-LEARNING DESIGN

Source	Title	Description
Ann (C)	Course Design Document (draft)	This is a design document for an e-learning product under development by Company Y for a federal agency. The document includes the following three main sections: Course Requirements, Course Architecture and Objectives and Design Elements. Within Design Elements there are five sub-sections: (a) types of interactive elements, (b) features and functionality, (c) exam material, (d) accessibility requirements (Section 508) checklist and (e) storyboard format. Throughout the section outlining the course objectives comments are inserted to alert the designer of concerns that a learning objective may impact 508. For example, the comment "Is this an activity? This will impact 508 and can easily be accommodated if planned for in advance" is inserted nine times.
Ann (C)	Design Document (draft)	This is a design document for an e-learning product under development by Company Y for a federal agency. The document outlines plans for the learning objectives, visual treatment, interface design, module content, and media selection. Within the media selection section, Flash is recommended as the development tool. One reason provided to support the choice of Flash was that it can be made both 508 and SCORM compliant.
Ann (C)	E-learning Asset Development Guide	This document serves as a supplement to the agency's Curriculum Development Guide (CDG) to ensure all e-learning assets comply with Section 508 requirements. The agency relies on the CDG as the authoritative source governing all course development projects. Accessibility considerations are mentioned throughout the document but primarily in Chapter 8, Compliance Specifications which covers SCORM compliance standards and accessibility guidelines. Within the typical e-learning development team, there are two team roles required to address 508 compliance, the Courseware Developer (approves storyboards and programs courseware following SCORM and 508 compliant practices) and the Quality Reviewer (ensures guidelines and specifications are provided to all on the development team and reviews courseware for instructional soundness, appropriate interactivity and functionality, SCORM and accessibility compliance). The document emphatically states that e-learning assets may not rely solely on a print-based alternative to satisfy accessibility compliance without written consent from the agency’s compliance office.
Beth (C)	Procedures for Creating Section 508 E-learning Content	Company X is in the process of creating internal documentation that outlines procedures for creating Section 508-compliant e-learning. This document is a draft and opens with a brief overview of Section 508. The remainder of the document focuses on practical development guidelines including how to work with text, design custom interfaces and work with tests and quizzes.

Source	Title	Description
Beth (C)	Accessible Question Examples	Examples showing how a question can be designed to test the same knowledge either in a straightforward 508-friendly way (e.g., multiple choice) or when accessibility is not required, in a more engaging or simulation-based approach.
Jean (G)	What is Learning	This document describes seven successful learning strategies for e-learning. The focus is on what should drive the choice of strategy for a huge range of e-learning formats. For example, active learning is a learning strategy. Specific e-learning strategies that support active learning are virtual worlds. Another strategy is prompt feedback; an e-learning strategy to support that learning strategy is email. There is no mention of 508 even though the product will need to comply with 508 requirements.
Jean (G)	Section 508 Checklist for Web-based Internet Information and Applications	Checklist used by agency based on official Section 508 checklist. Checklist includes 66 check point items. For each checkpoint there is a space for the Project Manager and 508 Compliance Officer to check "Yes", "No", or "NA" and to insert "comments". Completion of the checklist requires signatures of both the Project Manager and 508 Compliance Officer. Agency also has checklist specific to "Software Applications and Operating Systems"
Tom (C)	Government Provided Service for Accessible Learning Content Development	Presentation describing the National Technical Information Service, a government/commercial arrangement to provide secure, government hosted COTS (courseware off the shelf software). The presentation reviewed the company's experience with Section 508 compliant e-learning, the technical approach used, importance of building compliance into the technology and accessible e-learning considerations.
Tom (C)	The Challenge of Providing Accessible eLearning	White paper published by company that reviews issues, solutions and challenges that exist today with accessibility. The challenge is presented from the perspective of disabled learners and from the perspective of developers.

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