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Usable Accessibility in e-Learning

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Foreword

Abstract

Accessibility is a subset of general usability. If a particular website is technically accessible, it is not necessarily *usable* by a disabled user. Most people divide accessibility and usability into two completely different categories. They focus on one aspect of usability, the visual side, and ignore all aspects until the very end of the project at which time they make the necessary adjustments to make their work technically accessible. Often, people believe that by following the letter of the law, that is, strict adherence to Section 508's guidelines, they are making their website accessible. But that is like saying that strict adherence to HTML standards produces good websites. You can still have a terrible website and yet have fully validated HTML.

What is truly needed is for accessibility to be seen for what it is: an important component of usability. By the same token, usability needs to be seen for what it is, a component of adaptability to different learning styles. When an online course is designed to work for different types of learners, and when the definition of "different types of learners" includes disabled learners, it will succeed.

Audience for this Document

This document is primarily geared towards anyone who needs to develop online learning content for the U.S. Federal Government and is concerned about the implications of Section 508 and how it may affect their work. The material in this paper is useful to anyone working in the instructional design industry (whether at the academic level or the corporate level) that is concerned about accessibility in general. It is assumed that the reader has experience with instructional design or, at the very least, web design.

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This document grew out of a number of projects over the last few years as we developed the Workforce Connections e-learning and content management system for the Department of Labor and our own version EZRO (EZ-Reusable Objects, http://ezro.devis.com/) as we looked into issues of e-learning and accessibility. Primary contributors are Martin Hudson, Justin Stockton, and Patricia Cortes.

Introduction

This paper takes an in-depth look at the various issues instructional designers face including common misinterpretations of Section 508. It also examines the problems that Section 508 raises from a financial and bureaucratic standpoint. With these problems defined it then looks at the solutions. These include a look at what makes good instructional design, good pedagogy, and what it truly means for distance learning to be accessible.

In this section, we will cover the following:

- An introduction to distance learning and Section 508
- The layers of web-based distance learning
- The concept of *Learnability*
- The idea that accessibility means equal access to rich instruction

Background

As personal computers have become more and more commonplace (whether at home, at work, or at the local library or community center) educators and trainers have been increasingly delivering educational content to learners online or on CD-ROM. The web and CD-ROMs provide instructors a power tool for delivering rich, interaction lessons that can be accessed at the convenience of the learner. Over the last few years the technology behind the web has been steadily improving while higher bandwidth has become more commonly accessible through cable modems, DSL, or trips to the local public library that have allowed web content to begin to approach CD-ROMs in quality.

On June 21, 2001, Section 508 of the Rehabilitation Act of 1973 went into effect mandating that all Federal information technology be accessible to any citizen or Federal employee with disabilities. Section 508 provides the accessibility guidelines for computing devices, operating systems, applications, websites, audio and video equipment and more.

Our interest for this paper is in the guidelines specific to the design of websites, although they are just as valid for their CD-ROM counterparts, with a brief look at some relevant guidelines in the sub-sections on applications and video services. Any Federal employee or contractor creating a distance-learning course for either internal Federal use or external use by citizens must comply with Section 508. Many websites have sprung up describing Section 508 and how software applications and websites may be made compliant but, as we shall demonstrate, simply making a distance-learning course 508 compliant is not enough. True accessibility in distance learning means creating a learning experience that is just as rich, interactive, and rewarding for disabled learners as it is for non-disabled learners.

Layers of Web-Based Distance Learning

One of the most common questions people ask is about *Learning Management System* (LMS) accessibility. Unfortunately, not that many people actually need a full LMS. These systems handle intricate tracking of student progress through courses, their test scores, what they have completed or not completed and so forth. In many cases, people really only need to deliver *Just-in-Time (JIT)* learning. JIT refers to training for specific tasks that is needed immediately. The only tracking that may be needed is whether the learner completed the course. Otherwise, JIT/JIC is a rapidly deployed, targeted course to train someone on a very specific set of tasks or workflow.

Learnability

The ultimate goal of any learning endeavor is to learn something. While not a true word in the dictionary sense, we are using the term “Learnability” to refer to a course’s ability to effectively teach something. Think of it in terms of usability (the ease of use, the quality of the user interface) and accessibility (the ease of use for disabled users).

Learnability can be thought of as the product of the instructional approach (the pedagogy), usability, and accessibility as follows:

Pedagogy X Usability X Accessibility = Learnability

If any of these three are not considered (i.e., zero), then the learnability is also dropped to zero. All three are critical for effective education.

Accessibility is really a subset of usability. When something is accessible, it is usable by someone with a disability. Our contention is that true usability includes accessibility. Unfortunately, it is the sad fact that most people think of usability only for non-disabled learners and do not consider usability for all learners regardless of their abilities. Until the prevailing thinking changes, it is safer to consider accessibility on its own rather than as a piece of usability.

Due to our focus on accessibility and due to an established body of writing on traditional usability, we are not going to discuss usability for non-disabled learners but, instead, focus on accessibility and how it intersects with pedagogy. However, as Shawn Lawton Henry writes in his chapter in Jim Thatcher's *Constructing Accessible Websites*, "it is often difficult to distinguish between usability and accessibility, It becomes clear that many design aspects that are *good* for general usability are *required* for accessibility." (Thatcher et al, 2002.)

Accessibility Means Equal Access to Rich Instruction

One can follow Section 508 to the letter and still produce completely inaccessible *and* unusable distance learning. It is simply not enough to follow all points in the relevant parts of Section 508 in making content accessible. Instead, the goal should be to create a learning experience that is as rich as the experience is for non-disabled learners. For example, simply providing *alt* text for graphics, captions on a video, or a text alternative to an interactive Java Applet explaining that the learner cannot see the Java Applet is not enough. What is truly needed is *usable accessibility*. It is necessary to provide alternative equivalents for disabled learners that give all learners, no matter their abilities, the same education at the end of the day. As we move forward in this paper we will continue to return to this idea.

The Problems

Section 508 compliance should not pose a problem for instructional designers. However, for various reasons, it does. Some people are taking Section 508 too literally and following the letter rather than the spirit of the guidelines. Others are overcompensating in their efforts and creating websites that are actually far less accessible than they should be. But mainly, most people are treading accessibility as something done at the end, as part of the quality assurance phase of the project, rather than earlier.

In this section, we will cover the following problems:

- The creation of *unusable* accessibility and the reasons for it
- Policy issues which handcuff instructional designers
- Overcompensation in Section 508 adherence to avoid litigation
- Myths and misinformation about accessibility
- Bureaucratic issues including funding, or the lack thereof.

Unusable Accessibility

Accessibility is often approached technology-first. For example, Section 508 specifies that all graphics, multimedia, and the like must have alternative text-only description. Instructional designers are following this one aspect of the guidelines and adding *alt* attributes to every single tag that can take them and, thus, rendering their courses nearly useless for visually impaired learners who are forced to sit through descriptions of graphics that have no bearing on the learning whatsoever:

> A large blue semi-circle on the upper left of the page. The main logo, a red banner on a yellow background. A blue semi-circle underneath the logo. The main headline that reads "Learning About Contract Negotiations." A blue semi-circle on the left side of the page bracketing the navigation controls which are in red just to the right of the image. Etc.

As you can see from this example, the letter of the law is being followed but not the spirit. Describing the visual decorations is quite pointless and does nothing to enhance the experience of viewing this site for visually disabled learners. In fact, all of the descriptions bog down the site and put a wall up between the learner and the content. Who wants to listen to those descriptions of the page design every single time a page is loaded? A sighted learner only sees these graphics in the periphery. They are decorations or, at best, mood setters. What if, instead, the audible description read, as follows?

> Active Learning Lessons: Learning About Contract Negotiations. Link #1, Jump to navigational menu. [Page content begins].

This provides the key, relevant information up front: the educational provider (Active Learning Lessons), the name of the course "Learning About Contract Negotiations", a way to access the navigation of the site and then direct access to the relevant content right away. This is far more effective and useful.

This illustration may seem to be extreme, but it is quite common in the industry. People are following the guidelines without considering the usability for users approaching the site from an audio perspective.

In other sites, one may find video files which are captioned so heavily that every word spoken, every sound made, and every background noise is described in text making the captioning so dense as to make the video too cluttered to watch without frequent pausing. At the other extreme are videos that are only captioned as much as is required by Section 508 leaving crucial audible clues out from the text captions reducing the usefulness of the content. These same cases apply to text transcripts and audio captions as well.

These examples show how people are focusing on the technology and not focusing on the users. They are taking the rules Section 508 contains and using them to come up with technological solutions without looking at the intent of those rules and looking for solutions beyond just technology. Later in this paper we will discuss how to look beyond technology and approach accessibility through the purpose of the content and what you want the learner to learn.

Policy Issues

There is a great deal of misunderstanding surrounding Section 508 and what it requires and does not require. Unfortunately, the source of the misunderstanding is not always the designers but the people who set the policies on how compliance will be met. Some people take a highly literal of Section 508 and mandate practices that are restrictive and force designers to make bad choices.

Myths and Misinformation

There is a great deal of misinformation that leads people to make inappropriate design decisions in their courses. One of the more common is that many people believe that Section 508 requires the presence of a text-only version of the site that contains all information from the graphical version. Section 508 states that a text-only site is required when it is not possible to meet the requirements of the other fifteen key points in Section 508 §1194.22. If the designer is able to meet those 15 points, then no text-only site is required or mandated. Along these lines, some also believe that having a text-only version is sufficient, thus avoiding the work of the other 15 points of Section 508. This is a mistake for both the end user who is often left with a pale imitation of the main site, and for the content provider who has to maintain two versions of their content.

Another common misconception is that no Java Applets (or Flash or video or audio, and so on) are permitted in the site. While nothing of the sort is ever stated in Section 508, it is interesting how often

one hears statements being made to this effect. Section 508 allows applets and plug-ins so long as they comply with Section 508 §1194.21(a)-(l). Audio and video are permitted so long as the information provided by them is available to all users. (In all fairness, it is likely that people do not believe these are not allowed but rather feel it is safer to avoid them altogether to avoid problems.) There are issues with using more advanced technologies and maintaining accessibility.

An Un-funded Mandate

Section 508 is a mandate that carries no funding with it. Any work done updating legacy content or in making new content accessible must be paid for by the department or agency responsible. This implies that any endeavor should be accompanied by a cost/benefit analysis to ensure that the project is worth doing. In general, well-made instructional design should not be significantly more expensive as an accessible product than a non-accessible product for reasons we will explain later.

Accessibility as an Add-On

Too many designers create their courses and, at the end, work to make the course accessible. Unfortunately, this creates far more work than is needed. Especially when underlying assumptions about the course design turn out to be inherently inaccessible. This ends up requiring a dramatic redesign at the 11th hour, often leading to something far less potent than would have been designed had accessibility been considered earlier in the process.

The Solutions

This section details the various solutions to the problems described above. The quest for solutions reveals something both interesting and promising: the solutions are already known and understood. The key to making good instructional design accessible is to make good instructional design decisions. It is in adaptability to different learning styles and attention to effective pedagogy that we find the tools to make content accessible. Section 508 simply provides a guide for what things must be taken into account. Good instructional design provides the methods to carry this out.

In this section we will cover:

- Instructional design driving the process, not technology
- The three types of content
- The keys to effective instructional design
- That adaptability to learning styles is the same thing as providing accessibility

Instructional Design Drives the Process

Ultimately, the better the instructional design, the easier the content will be made accessible. This may seem to be a contradiction as many people equate good instructional design with using lots of bells and whistles, which, in turn, reduce the accessibility of the learning content. But, as we shall see, this is simply leading the process with technology rather than with instructional design or pedagogy. The entire process begins with instructional design.

As an example, if one were going to design a course to teach the use of pneumatic drills, one would not begin thinking about this at the technology level. One does not start with an idea for a Java Applet and end up with a course. Rather, one begins with learning goals and objectives, pedagogical approaches for achieving those objectives, investigations of the differing learning styles of the students who will take the course, and only after these items are determined does one begin to consider the technology one would use to carry out the goals with the students.

It therefore follows that making content accessible does not mean simple tagging and the adding of captions. Rather, the key is to develop instructionally equivalent content as needed. Exact mirroring of content that works well for sighted learners may not work at all for visually impaired ones, for example. Another way to look at it, which we will examine in more detail later, is that the idea is not to make the *product* of the instructional design (say, a CD-ROM or a web site) accessible so much as to

make the instructional design *itself* accessible. The starting point should be the beginning, not just one of the end results. Before we examine this concept in further detail, we should consider instructional design and what makes for good online learning.

Three Types of Content

Surface Content

All websites have a level of superficial content that are, essentially, decorations. They may be dividing lines, background images or patterns, an interesting border around the page, or many other things. They are, for all intents and purposes, "eye-candy." There is no good reason to make a visually impaired learner listen to descriptions of the visual appearance of the site, especially when that visual appearance has no bearing on the learning experience itself.

Contextual Content

This content is something of a middle ground between the surface and the curricular objectives content. Graphics and text in this layer are not directly related to the learning but are not merely decoration either. In a way, they frame the actual learning content and help to establish a setting or a mood. One example of this is a lesson about airline maintenance, which has, on its title page, a graphic of a plane with an old-style plane engine visible through the translucent nose of the plane. While this graphic is not anything being directly taught, it does set the stage for what is to follow. Whether or not these graphics are tagged for audio or text and how this is handled is up to the designer, but these are content items worth considering for accessibility. Mood setting is important and should be something that everyone can access.

Curricular Objectives Content

The content in this layer is the meat and potatoes of the instructional design. This is the material being taught and this is the content that needs to be made accessible in full.

Keys to Effective Instructional Design

The key steps to effective instructional design are:

- Know what kind of system you need
- Know your educational goals
- Know your audience
- Understand that different learners have different learning styles
- Know how to design to reach that particular audience via their different learning styles to reach your particular goals in the system you have chosen

Know What Kind of System You Need

We discussed the different types of systems above. It is very important not to select the wrong system because of a misunderstanding of what is needed. An LMS can be a powerful tool but is often more than is required. At the same time, there can be situations where a Just-in-Time/Just-in-Case system is too simplistic and something more involved is required.

Know Your Educational Goals

What do you want the learner to actually learn? These goals should always be written in the form of action verbs: The learner should be able to *do*…, The learner should be able to *demonstrate* knowledge of…, and so forth. Setting effective goals requires an understanding of what makes good instructional design, which means an understanding of basic educational theory.

While courses that employ static text and images are the easiest to make accessible, sites that employ high levels of interaction are much harder to make accessible. And therein lies the biggest challenge facing instructional designers: how to design courses that are highly interactive without sacrificing accessibility (not to mention bandwidth when they are hosted on the web). Research has repeatedly shown that students learn best when they are actively engaged in the learning rather than being

passive observers. David Perkins, of the Harvard Graduate School of Education, pulls many educational theories together into what he calls *Theory One* and lists four keys for effective instructional design: Clear Information, Thoughtful Practice, Informative Feedback, Intrinsic or Extrinsic Motivation (Perkins, 1992). These four elements provide a strong framework for designing online learning and we will examine each of the four in detail.

- **Clear information**: The learning goals, the broad outline of the lesson plan, and the content of the lesson itself must all be clear and well presented. Having hidden goals, obscuring the content or otherwise making the material hard to view will cause problems for the learner.
- **Thoughtful Practice**: The learner must have an opportunity to actively work with the knowledge provided. Simple multiple choice questions are a good start, but simulations, essay questions, or other opportunities for the learner to truly interact with the knowledge and use it constructively is best. As Donn Ritchie and Bob Hoffman stated in their article *"Using Instructional Design Principles to Amplify Learning on the World Wide Web,"* "How can we increase the possibility that learners actively process information? One way is to require them to develop an artifact of their learning." (Ritchie, D. & Hoffman, B., 1996) They go on to cite B. Dodge's summary of R. J. Marzano's eight specific strategies to help learners produce these knowledge artifacts. These strategies are requiring learners to
    - Compare
    - Classify
    - Induce
    - Deduce
    - Analyze errors
    - Construct support
    - Make abstractions
    - Analyze perspectives that they encounter in the course of their Web searches (Dodge, B., 1995; Marzano, R. J., 1992)

  Clearly, having students do all of these would require a Herculean development effort but you can see that getting learners to actively work with knowledge as opposed to reading slides on a screen is important.
- **Informative Feedback**: The learner needs to be given thoughtful, insightful, and useful feedback on how they are doing. It is not enough to say correct or incorrect. Rather, a why and a deeper explanation are best. Often this is an area where having an active human instructor is desirable to truly help the learner understand what they are doing well and what they need to work on further. To provide this in a distance education setting where there may not be a human instructor the website must be very well designed and capable of responding to a wide variety of situations so that the learner remains on track.
- **Intrinsic or Extrinsic Motivation**: The full unit should be as interesting as possible. If the lesson itself is intrinsically motivating, research shows that the learner performs best. If this is not possible for whatever reason, having an extrinsic reward is a suitable substitute.

Know Your Audience

If you are going to teach someone, you need to know what he or she are already bringing to the table and under what conditions they will be working through your learning materials. Will they be doing the course work at home or in their offices? Will they be interrupted a lot (thus requiring the ability to bookmark their place in the course frequently)?

If you are designing for a broad audience (say, all employees within a large agency) then you know that you are dealing with people at their desks that are highly interruptible, and likely need to get and out quickly. If you are designing for a small group of very specific people who will be expected to work on

the materials over a weekend in the privacy (and relative quiet) of home, you know that they will have more time and less interruptions.

Understand that Different Learners have Different Learning Styles

Different learners approach learning materials in different ways. Some are more visual in nature and work well with pictures, diagrams and the like. Others are more language based and work better through analogy and description. When designing any learning materials, it is critical to make it as multi-modal as possible. Provide a picture and a description of the concept the picture embodies. Provide a complicated concept but also provide descriptive tabular data that illustrates that concept, and so forth. Otherwise, only a subset of your entire audience will get the full benefit of the experience.

Designing Effective Education

Once you have the first four elements in hand, you are in a position to create the learning materials or to procure the services of someone who can create them for you. But it is not until you have the above items can you successfully get to this point.

Accessibility in e-Learning

Given all of the above, you might think that you already have your hands full without even considering accessibility. But it is armed with all of the above that we can finally reveal the secret of accessibility: disabilities, or rather *remaining abilities,* can be considered (in this context) different learning styles.

Rather than talking about a visual- or language-based learner, expand your thinking to an auditory versus a visual (only) learner or a learner who prefers to read and not interact with a mouse versus one who only wants to use a mouse and wants all text read to them out loud by a synthesizer. If you approach disabilities from this perspective then suddenly the issue is not how to take a given web page, video, graphic, or quiz and make it accessible but rather the issue becomes how one creates instructional design that works for all learners and their various *abilities*.

Approaching accessibility from the point of taking the course itself and making it accessible is starting at the end and is far more difficult and expensive. If accessibility is considered part of accommodating differing learning styles, it fits naturally into the original process and allows you to create a course which is far more adaptable to a wider variety of learners, disabled and not.

Accessibility Increases Usability

Another great secret is the benefits of accessibility on overall usability. When done correctly and well, accessibility benefits all users, not just the disabled. One of the best real-world examples is the sidewalk ramps for wheel chairs at street crossings. They were designed specifically for wheel chairs but everyone uses them and benefits from them. And sidewalk cutouts do not cost a city any more to install than regular curbs, so too accessible websites should not cost more than “regular” websites when the design includes accessibility from the start. Trenton Moss (2004) wrote a good list of benefits to usability that accessibility provides:

- **Descriptive Link Text**: Rather than writing, “click here” for a link one should write links so that the text of the link itself describes the content on the other end. Screen readers present links in a separate list that makes this critical. But a sighted user can also visually scan the page quickly and obtain the same benefit.
- **Form Labels**: Labels are an HTML tag, which tie form elements (text entry fields, check boxes, menus, etc.) with their descriptive labels. By using this tag, a side benefit for all users is that not only is the form element itself clickable via the mouse, the entire block of text describing it is as well.
- **Information Chunking & Simple Language**: All users benefit from having information broken down into smaller chunks that are easily digestible versus long, extended blocks of text.

- **Site Map**: Site maps are essential for users of screen readers and similar tools so that they can easily locate specific information within a site. But site maps have proven useful for all users.
- **Consistent Navigation**: Having a simple, consistent navigation scheme across and entire site benefits all users.
- **No Un-Announced Popups**: While these are annoying for all users, they can be extremely disorienting for users of screen readers and the like. Always requiring a note with each link that a pop-up window will result from clicking benefits everyone.
- **Cascading Style Sheets for Layout**: Using CSS for layout has benefits across the board to accessibility, usability and beyond. Information is marked up simply and clearly and the complicated visual appearance is maintained separately. This allows the content to be styled in any number of ways while not creating roadblocks to the information that are often put in by table-based layout.
- **Transcripts for Audio/Video**: Transcripts for audio are essential for accessibility but are very useful for all users. It is much easier to scan a transcript to go back to a specific quote than it is to move through an audio or video file.
- **No Flickering or Unnecessary Animation**: Essential for users with epilepsy, removing these benefits all users. There are many web designers that think it is cute and fun to provide silly animations but they almost always detract from the usability of the site by providing distracting elements within the field of view. (List after Moss, 2004)

Clearly usability and accessibility go hand-in-hand. Each benefits the other and attention to both, simultaneously throughout the design process, is the secret to usable accessibility and therefore excellent learnability.

Conclusion

Good instructional design begins with educational goals and builds learning based on pedagogy and a strong knowledge of how learners learn and how best to present the material. Adding accessibility to the process at the planning stage and considering as part of the process of making the learning experience adaptive to different learning styles allows for a much richer educational experience that is fundamentally the same for all learners regardless of their abilities. This approach reduces costs over retroactive updating and ensures the quality of the learning experience. Strict adherence to Section 508 without considering the experience of the learner is a recipe for inaccessible learning content.

References & Further Reading

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Online Resources

The Web Access Initiative: http://www.w3c.org/WAI/

The Web Content Access Guidelines: http://www.w3.org/TR/WAI-WEBCONTENT/

Section 508 Resources (full text and much more): http://www.section508.gov/