No Compromise – An Innovative Section 508 Approach Supporting All Learners

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ABSTRACT

The Veterans Health Administration (VHA) is the Nation's largest integrated health care system. The Employee Education System (EES) maintains and advances VHA's state-of-the-art learning delivery models and fosters innovative training opportunities such as virtual and self-directed learning. Ensuring that online and on-the-job training is accessible to all learners, including those with disabilities, is mission-critical for EES.

Designing online training that is accessible to all learners can pose a dilemma for instructional designers. In the case of compliance with accessibility regulations—spelled out in Section 508 of the Rehabilitation Act (29 U.S.C. 794d)—designers have sometimes abandoned optimal instructional strategies in favor of those that will support accessibility, particularly for vision-impaired learners who use assistive technologies like screen readers.

An on-going collaborative effort between EES and a non-profit research and development team takes the position that instructional designers should have the freedom to design engaging training, regardless of audience constraints, by enlisting technology that transforms the final product to meet the needs of all learners.

The authors present a case study of innovative Section 508-compliant training recently implemented in support of the VHA Office of Telehealth Services. The ground-breaking approach focuses on innovation, not compromise—dynamically transforming interactive training content to an accessible format on-demand. The content transformation process reformats the original multimedia training content, displaying it as rich-media interactive, 508-compliant HTML5 for learners who choose this view. The multimedia and accessible display formats are both generated from a single-source content file, which is built from a library of instructional interaction templates.

The authors provide detailed information on the design and development of the Telehealth training and present lessons learned and recommendations. In addition, thoughts on next steps will focus on enhancements to ensure training is effective and accessible across both desktop and mobile display formats.

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INTRODUCTION

The Veterans Health Administration (VHA) is the Nation's largest integrated health care system. The Employee Education System (EES) maintains and advances VHA's state-of-the-art learning delivery models and fosters innovative training opportunities such as virtual and self-directed learning. Ensuring that online and on-the-job training is accessible to all learners, including those with disabilities, is mission-critical for EES.

The VA leads the way in hiring service-disabled veterans and also leads the effort to ensure compliance with standards and mandates. "We hold people's feet to the fire" when it comes to accessibility for disabled workers. "We want to ensure our disabled veterans, employees, and members of the public have equal access to information," says the VHA's Section 508 Office.

Many other Federal Agencies hire disabled workers. RoseAnn Ashby is a GS-14 Branch Chief working in the U.S. Department of Education since 1987. She is blind and uses a computer equipped with a screen reader with speech output. "Prior to my having a personal computer supporting speech, various tasks were burdensome processes. With the advent of accessible computer technology, I now find that I am as efficient and productive as any employee with sight, and I am considered a high performing staff member of the agency" (Success Stories, 2012).

There are many other success stories associated with implementing Section 508 requirements. What is Section 508, how has training technology evolved, and what can we do even better?

The VA leads the way in hiring service-disabled veterans

Panic Day

Over a decade ago many industry and government executives were looking ahead to June 25, 2001, as a "panic day," said Terry Weaver, General Services Administration. On that day, a new federal procurement regulation would take effect, requiring agencies to buy information technology that is accessible to people with disabilities and to create accessible web content (Emery, 2002).

Many in industry, including the authors of this paper, were struggling to understand the standards so we could make our training products compliant. According to Gail Repsher Emery, many in government felt similarly pressured: They faced the threat of lawsuits and administrative complaints if they did not accurately interpret the standards and buy the best accessible products—there was a huge fear factor. According to Emery, "the fears, it turned out, were largely groundless" (2002). Unfortunately, in the area of e-learning, some of these fears may have been alleviated by focusing on a"lowest common denominator" strategy that sometimes compromises instructional integrity.

A "Lowest Common Denominator" Strategy for Section 508-Compliant E-learning

In 1998, the US Congress amended Section 508 of the Rehabilitation Act (29 U.S.C. 794d) to require Federal agencies to make their information technology accessible to people with disabilities (www.section508.gov). The amended Section 508 was intended to eliminate barriers in information technology, to make available new opportunities for people with disabilities, and to encourage development of technologies that will help achieve these goals. To comply with Section 508, agencies must give disabled employees and members of the public access to information that is comparable to the access available to others. As noted in a related paper (Bandrowski, Clark, 2010), typically, this means simplifying the display of information and making alternative text-based content available.

While accessible training is a critical need, designing information technology available to all learners has sometimes created challenges for instructional designers. In order to be in compliance with Section 508 accessibility regulations, designers have sometimes abandoned innovative instructional strategies in favor of those that will support accessibility, specifically for vision-impaired learners. These learners often need to use assistive technologies like screen readers (Bandrowski, Clark, 2010).

Instructional designers have recognized that for some training interactions, it is difficult or even impossible to design for accessibility and therefore avoided these interactions altogether (a simple "drag and drop" exercise for example). Section 508 compliant e-learning is often "lightweight" text-based content with simple interactions and only essential visual media coupled with "alt tags" (alternative descriptions of graphics that can be "read" by screen readers). All too frequently, interactive rich-media training is abandoned altogether in favor of a simplistic but compliant "page turner" text-based forms of e-learning.

INNOVATION, NOT COMPROMISE

An on-going collaborative effort between VHA's EES and a nonprofit research and development team takes the position that instructional designers should have the freedom to design engaging training, regardless of audience constraints, by enlisting technology that transforms the final product to meet the needs of all learners (Bandrowski, Clark, 2010).

The team recently implemented innovative Section 508-compliant training in support of the VHA Office of Telehealth Services (OTS). The ground-breaking approach focuses on innovation, not compromise—dynamically transforming interactive training content to an accessible format on-demand. The content transformation process reformats the original rich-media training content, displaying it as interactive, 508-compliant HTML5 for learners who choose this view. The multimedia and accessible display formats are both generated from a single-source content file, which is built from a library of instructional interaction templates.

The sections below provide detailed information on the design and development of the Telehealth training and how the technology evolved. In addition, lessons learned and further recommendations are presented.

The Foundation – Single Source Transformations

In 2007 the team began working on a large VHA training project ensuring that the training was Section 508-compliant. While the training may have been compliant, we are not proud to admit that the focus at that time was only to provide a text-based alternative.

Since some of the Flash-based training content was difficult or impossible to make accessible (see information below), we provided an accessible text document instead. The process of providing accessible text-based content involved going back to paper-based storyboards and extracting the content by hand and publishing it as a PDF document. Sight impaired learners could find the link to the alternative document, launch it, and have screen readers provide them a "data dump" of content.

Besides providing only a text document, the other problem associated with this process was related to version control. It was in trying to solve the version control "conundrum" that we stumbled upon a broader solution to the Section 508 problem. The version control problem involved having to update the accessible documents every time any content was changed, which was frequent. We had to find a way to automate this process. Our lead developer offered a solution—XSLT or Extensible Stylesheet Language Transformations. This transformation process enabled the team to not have to create the accessible documents by hand, as they could be generated dynamically and on-demand by transforming the XML-based training content to a text-based presentation in real time. Given that the content was based on the single-source XML, the accessible documents would reflect the latest revisions.

Text Reference Transformations

While we no longer worried about version control, those accessible documents were still just text-based "data dumps."

While still useful, Section 508-compliance is no longer the focus of the text-based documents created using these dynamic transformations. Though, the transformations have turned out to be useful for learners interested in quick access to lesson content via a printable reference document. Text reference documents may be used to review the training material or as a way of quickly accessing critical information buried in the training—a kind of job aid or reference document.

Figure 1 shows screens of the training interface and the icon that launches the transformation producing the text reference document (Figure 2).

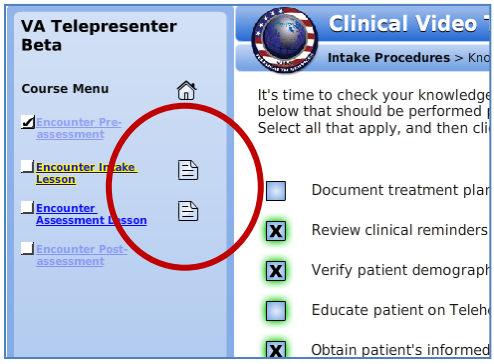

Figure 1. Icon launches the transformation producing the text reference document

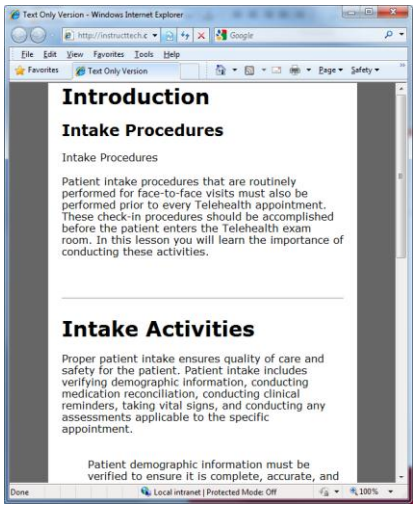

Figure 2. Dynamic text reference document

"Comparable Information" versus "Comparable Experience"

As noted above, to comply with Section 508, agencies must give disabled employees access to information that is comparable to the access available to others. Over the last number of years, the VA and other organizations have determined that simple text-based alternative documents may not be acceptable. While they may provide comparable information, they do not provide a comparable experience—meaning training that provides pre-test evaluations, sequenced presentation of content, check on learning feedback, rich-media information, assessments, etc.

As organizations like the VA began rethinking what is required for compliance, the team was starting on a research and development effort to see if the transformation process implemented earlier could be extended and enhanced to meet the "comparable experience" goal without compromising any instructional design.

Where It Started – Making the "Ball Game" Accessible

Figure 3 below shows an example game interaction that is visually oriented and involves a simple drill and practice instructional approach. The instructional design is meant to allow learners to quickly make choices and receive feedback with the goal of memorizing equivalents and achieving "automaticity," or having equivalents become automatic for the learner. This was done by using a game-like interaction where balls "fly" across the screen with the goal of quickly choosing the correct equivalent (ball) before it disappears. Ever since the game was created by instructional designers, the question of 508-compliance has followed it.

As part of the R&D effort by the nonprofit team, ISDs and instructional developers pondered how a learner with visual impairments could be supported given the same instructional goal—memorizing equivalents. The answer was a similar interaction but a different presentation. The series of balls being presented would be replaced with a series of multiple choice questions accessible to learners using screen readers and keyboard shortcuts. The questions are presented one at a time and an adjustable audio-based timer forces the learner to respond before the game moves to a new question. A correct answer allows the game to continue, but an incorrect answer forces a retry, restarting the game.

In figure 3, the original Flash-based interaction is shown with the moving balls, equivalence question, and scoring aspect. In figure 4, the accessible version is shown with multiple choice question, timer, and score.

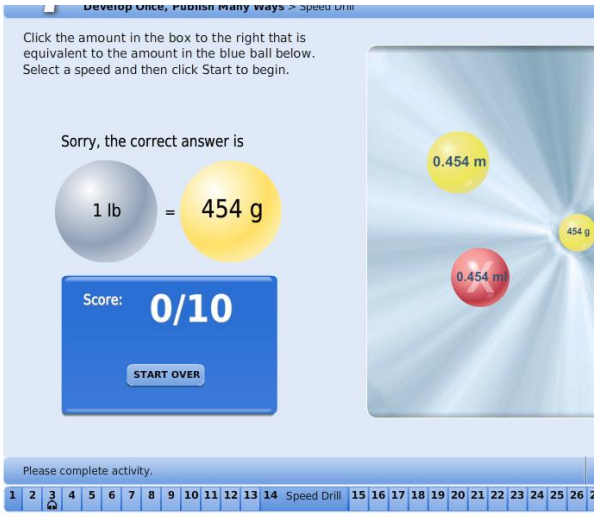

Figure 3. Visually-oriented game-style "speed drill" interaction – difficult to make accessible

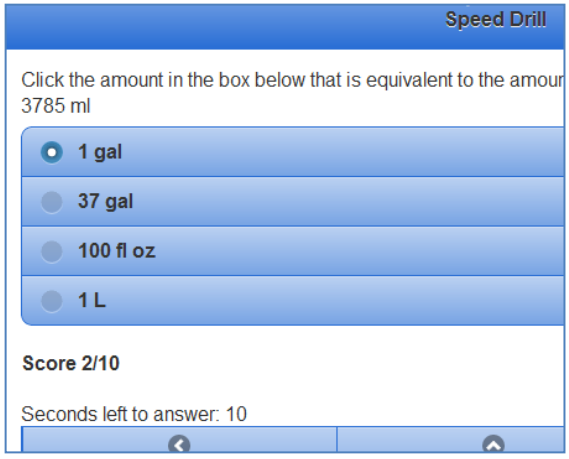

Figure 4. Transformed, accessible version shown with multiple choice question, timer, and score

Once the accessible version was designed, developers still had to dynamically transform the original interaction to the new presentation. Using the XSLT transformation process proved out earlier, the new HTML5 interaction presentation was created from the orignal XML single source content. With this process and technology, we had the foundation for taking our library of interaction templates and creating an interactive Section 508-compliant alternative version for each template, available on demand when needed by a disabled learner.

PROVIDING A COMPARABLE EXPERIENCE – TELEHEALTH CASE STUDY

Telehealth Clinical Technicians (TCT) Online Training

EES supports the VHA with the delivery of high-quality, patient-centered care and service to the nation's veterans and facilitates learning opportunities that help lead to performance excellence and improved delivery of service. The VA medical centers employ a "telehealth" workforce to manage care across the VA health care continuum. Telehealth is the delivery of health-related services and information via telecommunications technologies. Telehealth Clinical Technicians (TCT) support the patient and health care provider in a clinical setting. EES had a need to create high-quality interactive multimedia web-based training for TCTs who perform job functions under the stewardship of the Office of Telehealth Services (OTS). Training for staff was essential and must be available on-demand 24x7x365 and include feature rich and instructionally effective content.

Since the VA leads the way in hiring service-disabled veterans, the training also needed to be Section 508 compliant and instructionally effective, even for those that are sight impaired. The training also needed to focus on a streamlined design and development approach producing high quality interactive online training in a effecient and cost-effective way.

The primary purpose of this training is to increase competence for new technicians in telehealth exam skills such as preparing the exam room and technology, orienting patients, taking pre-visit vital signs, assisting during the exam, and completing paperwork. The training uses a scenario-based instructional approach to introduce concepts to learners and provide them with opportunities for application. Experienced telehealth technicians also use the training to refresh their job skills. Figure 5 shows a screen of the video scenario-based interactive web-based training.

Figure 5. Video scenario-based interactive web-based training

A Library of Interaction Templates and Accessible Presentations

A goal of the online training was to not only ensure Section 508-compliance but also ensure that no instructional compomises took place in designing, developing or implementing the training. The training needed to be effective for all learners, those with disabilities and those without. To accomplish this, the team built on the successes from the early R&D efforts associated with dynamic XSLT transformations—both text-based as well as transformations to fully interactive media-rich training.

The team began a process of designing and developing the alternative versions for a portion of the interaction template library. Interaction templates use instructional approaches to facilitate learning, which can be transformed to alternative presentations. About 20 templates needed alternative presentations, only those that were relavant to the telehealth training. The process would take some time—approximatley a month—but once complete, any new training could now be published to the alternative presentations. The process involved an ISD reviewing the original instructional intent of the interaction template and then designing an alternative presentation that supports screen readers and keyboard shortcuts but did not compromise the instructional goal of the interaction. Figure 6 shows a screen of an alternative accessible interaction presentation. This interaction is a check on learning "flash cards" exercise similar to the Flash version but accessible via screen reader technology.

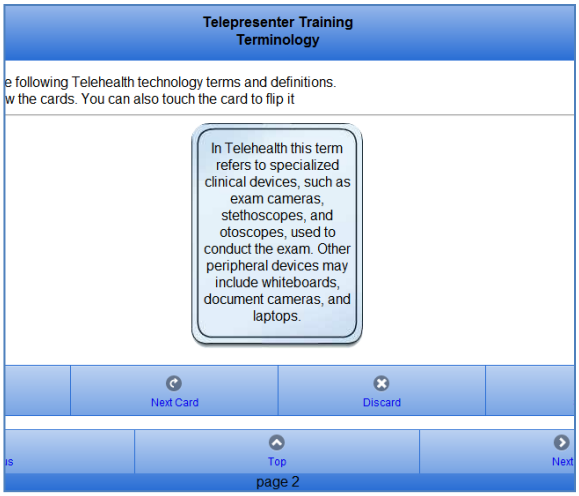

Figure 6. Accessible HTML5 "flash card" knowledge check interaction

Once all the alternative presentations targeted for the training were designed and developed, they were submitted to the VA's Section 508 Office for review and feedback. The Section 508 Office consists of experts on accessibility regulations and development approaches. Many are disabled themselves and use assistive technology on a daily basis. While the alternative presentations were being reviewed, ISDs began designing the training and populating the interaction template forms with content. These forms capture the training content and output to single source XML, which populates the interaction presentations. Figure 7 shows a interaction template form populated with content which will output single source XML.

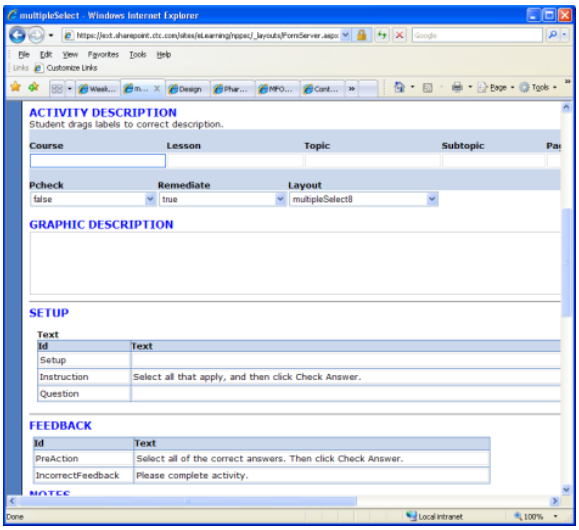

Figure 7. Interaction template form populated with content ready to output XML

Interactive Flash-based TCT Training

With the interaction template forms populated with content, and media referenced within the forms, the training was then "published" to the initial Flash-based presentations. The three hour training includes an introduction lesson and eight modules. Each module includes a pretest, lesson and post test. The pretest was based on a video scenario and required the learner to pass at 100% in order to skip the lesson and post test, but it also provided feedback and an advanced organizer to help learners prepare for the lesson material. The lessons include rich media video-based content, interactions, and check on learning activities. Post tests focus on branching scenarios allowing learners to apply their knowledge and can be retried and lesson material reviewed as many times as the learner needs. Modules are available in any order and completion takes place when all tests are passed.

Per the vision of the Advanced Distributed Learning (ADL) initiative, all content is meant to be shareable. While all pretests, lessons and post tests are independent shareable content objects (SCOs) and could be sequenced via a SCORM 2004 package, they were instead "bundled" into a "course player" that sequenced the objects to learners. The course player acts a simple, single SCO SCORM package, with no complex SCORM sequencing which maximizes the chances of successful implementation across multiple learning management systems (LMS).

The question still remained – could the team ensure that a blind user would receive an equivalent experience given a complex course like the TCT training with pre and post tests, rich media, interactive content, and video based material? Based on initial feedback from Section 508 Office on the accessible template presentations, we believed we could.

Meeting the Needs of All Learners - An Accessible and Comparable Experience

Once the new accessible presentations were reviewed by the Section 508 Office, they were incorporated into the training. When a disabled learner needs the accessible training the new format is available dynamically, changing from a multimedia Flash presentation to an accessible HTML5 presentation but still based on the same single source XML content.

The first screen that is presented to the learner is a preference screen asking which format do they prefer—Multimedia Flash or Accessible HTML5? Of course, screen readers would read the question to a blind learner. Figure 8 shows the initial screen.

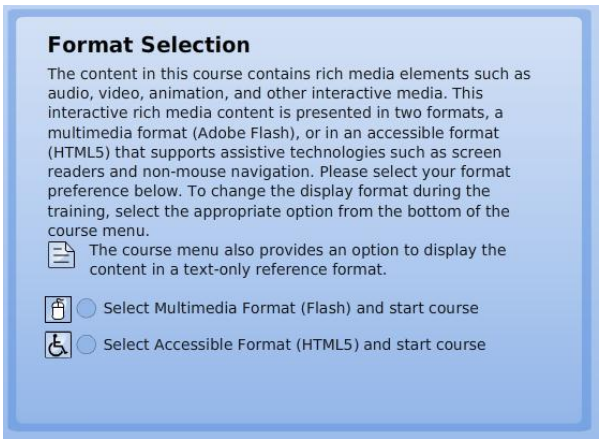

Figure 8. Initial preference screen in training

At any time the learner can choose to return to the Flash format and back to the accessible format. Figure 9 shows the options available on the user interface.

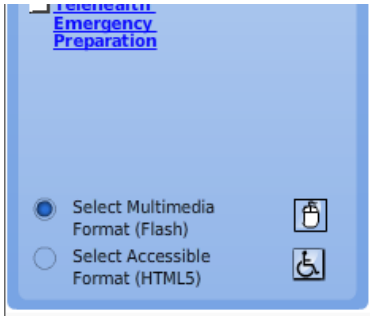

Figure 9. Learners can toggle from the Flash format to accessible HTML5 format.

The eight modules are presented to the learner via the accessible Flash-based course player menu allowing learners to choose a path through the content. Figure 10 shows the accessible menu.

Figure 10. Accessible Flash-based Course Menu

Once a module is chosen, the learner enters the pretest and completes questions while receiving feedback. Figure 11 shows the pretest with a Flash format. Figure 12 shows the same pretest page with the HTML5 format.

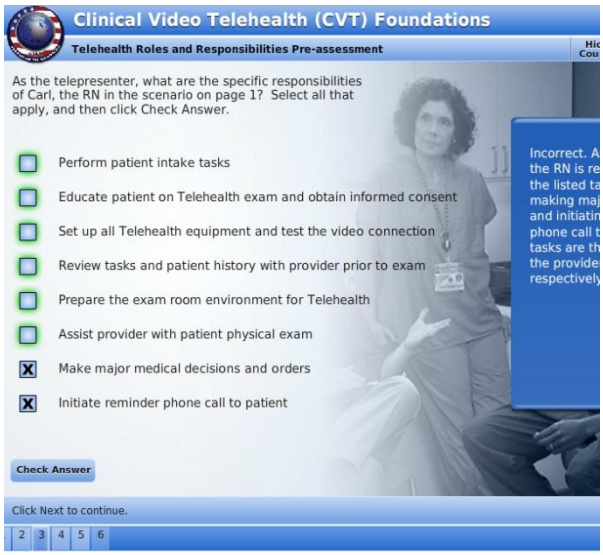

Figure 11. Pretest with Flash-based Format

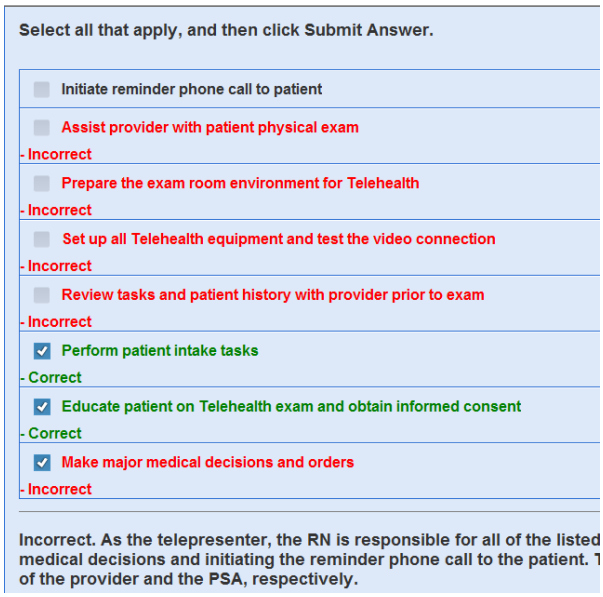

Figure 12. Pretest in accessible HTML5 format

With the accessible format, video-based content is still available but with closed captioning. All pretest questions have feedback available and scoring information is given at the end. Figure 13 shows an example of the accessible pretest video screen with closed captioning.

Figure 13. Accessible pretest video scenario with closed captioning support

Lesson material is sequenced to the learner after the pretest. The accessible lesson pages provide interactive content with check on learning activities with feedback. Figure 14 shows an example check on learning "drag and drop" interactions with figure 15 showing the same interaction formatted in HTML5.

Figure 14. Flash-based check on learning "drag and drop" interaction

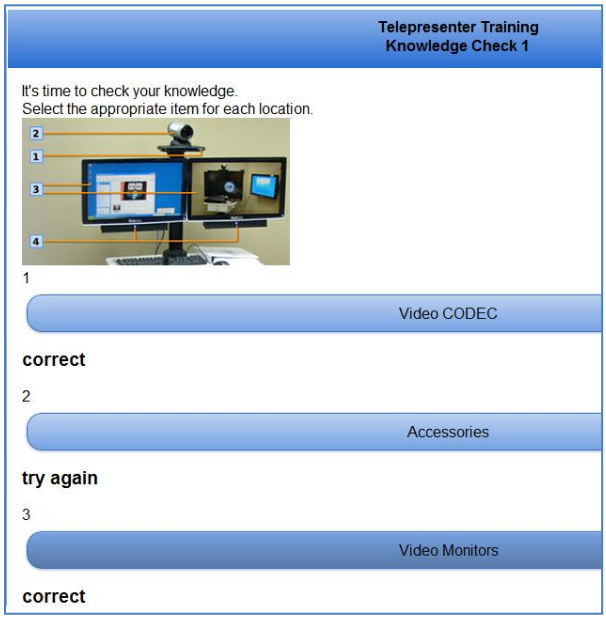

Figure 15. Accessible HTML5 "Drag and drop" using image call outs and a drop down menu

As you can see from the screen shots, the visually impaired learner or other person needing accessible training will receive essentially an equivalent experience with all the same media, feedback, sequencing, and assessments as the multimedia Flash format.

The training is currently being implemented across the VHA beginning summer 2012. So far the feedback has been very positive. From various stakeholders: "I have received a lot of feedback from the Project Team. They are all very excited and extremely positive;" "The feedback has been WONDERFUL!!!."

A "DEVELOP ONCE, PUBLISH MANY WAYS" APPROACH

While the "Panic Day" in 2001 started everyone thinking about accessibility, it was not until six years later that a foundation was laid for our "no compromise" accessibility approach. Starting in 2007, the team began to consider ways to maximize development efficiencies by integrating a suite of XML-ready commercial-off-the-shelf tools to streamline development (Bandrowski, Castillo, 2009). The integrated toolset or "platform" now known as XPERT (*XML-based Platform for E-learning and Rapid Training*) is a set of non-proprietary tools and technology to efficiently design, develop, and deploy e-learning. The key to efficiency is single-source, XML-based content that can be transformed or published to alternative formats. As shown above, multimedia Flash and Section 508-compliant accessible formats are critical, but other formats are available as well, including mobile-friendly formats, text-based or print, or even formats for instructor-led training (Figure 16).

Figure 16. A develop once, publish many ways approach

Based on experiences using the XPERT Platform to "push the envelope" of Section 508 accessibility, a number of lessons learned were captured and some additional next steps are being considered including ensuring mobile learning is accessible.

Lessons Learned

The most important lesson learned was that it is imperative to work closely with a team of disabled learners to ensure valid instructional approaches and software accessibility.

We were fortunate to have access to VA's Section 508 Office and their support team. They were involved from day one reviewing our transformation vision and providing advice. Later in the project they reviewed the courses and provided detailed notes on improvements. It is very difficult to replicate the experience a disabled person goes through when using assistive technology to function on a daily basis.

A second lesson learned had to do with the need for additional media and content associated with Section 508 presentation formats. In some cases the presentation changed from a visual drag-to-picture, to an image with callouts and a drop down menu. Of course the visually impaired cannot see the picture so additional descriptive information is available but only via screen readers (Figure 14 and 15 above). Since the

picture with call outs was needed for the accessible presentation, the image was created and referenced in the instructional template form ready to be accessed upon transformation. In some cases, directions were also replaced and needed to be included in the forms so they could be used in the new presentations.

A third lesson learned was that the level of effort associated with QA increases with this approach. Even though content is based on single source XML, the training is still presented in two formats, with each needing quality assurance reviews. The more refined the transformation, the less QA will be needed, but there is always some QA regardless.

Next Steps and Recommendations

As was noted, the more the transformations are refined, the less QA is needed. The goal is to refine the transformations and presentations, not the custom training. The best way to refine is to work directly with disabled consultants including those with visual impairments. Our team is in the process of hiring a blind computer technician to support refinements. This person will work alongside our team, helping us to understand what is needed for effective instructional interactions and quality accessible training.

Refine the training by working directly with disabled learners including those with visual impairments that rely on audio.

Another next step involves continuing to streamline the transformation process, ensuring a seamless, smooth, and dynamic process for "pushing" content XML into the various presentation formats including accessible HTML5.

In the months ahead, the team is also working to add accessible HTML5 presentations for all existing interaction templates. The current template library consists of approximately 50 templates with 30 having accessible presentations. In addition, new instructional approaches are being turned into templates, including "backwards and forwards chaining" and a "minimal prompt exercise" template.

Interestingly, it turned out that the accessible HTML5 presentations actually worked well within the mobile browser on various smart phones, tablets and even feature phones (Figure 17). A next step is to continue to refine the transformations and presentations for mobile devices. This includes adding versions of images to the forms specifically designed for mobile, as well as alternative directions such as "tap" as an alternative to "click."

With mobile becoming increasingly important, users with disabilities are taking advantage of their devices to support daily activities, including learning. Many smart phones have accessibility functions that are very promising. The team plans to continue focusing on single source training content being pushed into mobile friendly presentations but also ensuring that the content is as accessible as possible.

Figure 17. The Telehealth training was also transformed to a mobile-friendly format

For Amy Ruell, who is blind, "new smart phone technology has the potential to give blind users unparalleled accessibility. With its emphasis on

inclusion—screen reader and voiceover now built in—some [smart phones] are revolutionizing our thinking."

Recommendations

Recommendations for those considering adopting a similar technology approach include:

1) Focus first on quality instructional design embedded in software templates ensuring instructional effectiveness.

2) Ensure alternative HTML5 presentations are accessible and 508-compliant.

3) Separate presentation from content by abstracting the training material into XML. Develop a foundation of single source XML.

4) Either "push" the XML into accessible HTML5 presentations or transform the XML to HTML using XSLT or another transformation process.

5) Consider adopting the XPERT open source technology.

XPERT Technology

As noted above, the team's experiences with accessibility and associated lessons learned grew out of developing and using the XPERT Platform. A series of Government projects and private research and development efforts resulted in the platform, which may answer specific needs of Government organizations. The tools associated with XPERT have been steadily maturing since 2007 and may be available to Government and non-commercial organizations for adoption via an "open source for Government" initiative that is currently being established. The nonprofit team conducts research in the public interest, emphasizing rapid technology transition. The vision of the open source initiative is collaborative enhancements that benefit all Government participants.

One goal associated with the XPERT technology was to have a model for efficient and cost-effective e-learning development that can be replicated for other courses. This goal is coming to fruition as new VA e-learning projects come online. Another goal associated with the XPERT Platform is to help other government organizations implement accessible training, meeting learner needs without compromise. This is also coming to fruition as an open source for government initiative gets stood up. For more information on the open source technology, please contact the authors.

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