CALIFORNIA STATE UNIVERSITY
MONTEREY BAY

Universal Design & Web Accessibility: Web-based Instruction for College Students

CAPSTONE FINAL REPORT

Submitted in partial satisfaction of requirements of the degree of

MASTER OF SCIENCE in

Instructional Science and Technology

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Capstone Approvals: (At least one advisor and capstone instructor should approve)

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EXECUTIVE SUMMARY

The American Disabilities Act of 1990 was established to provide equal access to public buildings and facilities for the disabled. With the advent of the Internet and other electronic media, the ADA was also applied to any technology used by the public, including websites. Lawsuits were brought against commercial websites that were not ADA compliant as well as other public facilities, including universities and government sites. College students who are studying with the intention to enter the career field of website design will need to create websites that are universally accessed by all users.

The instruction designed for this project is a website containing a series of six tutorials ranging in length from 10 to 30 minutes (depending on student progress) and resources to help students learn beyond the tutorials. The first stage of this project is finished with two tutorials completed, Tutorials 1 and 4. The website and tutorials are also ADA compliant. The tutorial topics are as follows:

- Tutorial 1: An Introduction to Accessibility – Overview of accessibility
- Tutorial 2: All About Alt Tags – Create strong alternate text tags for images and other code-based accessibility guidelines.
- Tutorial 3: Look Ma, No Mouse. Navigation Essentials – Tips for strong navigation, testing keyboard navigation in browsers
- Tutorial 4: Test Your Site. Accessibility and Usability – Tools and strategies for testing the accessibility and usability of a website
- Tutorial 5: Accessibility Meets Universal Design Principles – Overview of universal design principles in relation to accessible websites
- Tutorial 6: What's Next? Future of Web Accessibility – HTML 5 Accessibility

The target audience for this instruction is college students in web design and development courses at colleges or universities. The tutorials are designed for beginning and intermediate students. Students range in age from young adults to older returning students. Beginning students need little knowledge of website building to begin the

tutorials but should have basic computer skills. Intermediate students should have pre-requisite knowledge of building a simple website including images. The instruction is designed to teach some design and coding skills as part of teaching their importance in connection with web accessibility. The instruction is not meant to replace in depth instruction in web design but to accompany course curriculum or be a stand-alone primer to further instruction.

The overall objective of this instruction is to educate students on the importance of accessibility in the website projects they create and to teach methods for improving and testing the accessibility of the sites they design. Each tutorial has specific objectives for students to learn and together the goal is to better educate students on the topic of web accessibility/universal design.

Summative and formative evaluation has been conducted with the target audience to see if the objectives of the tutorials were met and determine problems with functionality. Pre and post quizzes were used for summative evaluation with a sample of college students in the classroom. Summative evaluation was conducted with this same sample using a survey of questions for feedback on the instruction. An in-person feedback discussion was also held with this group. Usability testing was conducted with this group of students through observation of them using one of the tutorials and from targeted questions during the feedback session.

The designer of this project intends to continue working on the instruction, in her free time, after graduation to complete all of the tutorials. The potential client for this instruction is a professor in the web design curriculum at a university. The designer intends to discuss the project being included in his curriculum at a future date, making it available to its target audience. The designer will also use this project as part of her online portfolio for hiring purposes and ideally would like to see if the project could be marketed for sale to colleges or commercially to a wider target audience.

INTRODUCTION/BACKGROUND

The passage of the American Disabilities Act of 1990 put a spotlight on the need for accessible public facilities for the disabled. With the rise of the Internet and shopping online, the ADA began to apply to websites as well as in-person stores. Also, online education and government sites were required to be accessible to those with disabilities. Therefore, teaching those studying website design about accessibility and how to create websites that are universally accessible to the most possible users has become part of the necessary curriculum in college courses on web design and development.

Problem Description

With the ever changing web design career field, courses are struggling to keep their curriculum up to date and cover basic as well as advanced material. This can sometimes lead to universal design and web accessibility being overlooked in priority or not covered in the detail necessary. The designer of this project used her own experience with a university web design curriculum, interviews with faculty and former students, online research of existing curriculum in the subject, and surveys of introductory students studying web design to determine if a gap existed in the web design curriculum of a typical college program. New students, as shown in survey answers, knew little about the importance of web accessibility or the basic elements of how to make a website more accessible. Former students, who had taken more advanced courses in the subject, felt that they would have liked more training in how to test the sites they create to check for accessibility problems. Faculty members wanted students to be able to produce sites that not only meet the legal standards for accessibility but also are designed with the principals of universal design to allow students to go into the career field creating sites with accessibility to as many people as possible. A search of some of the existing resources for teaching web accessibility showed a lack of interactive or engaging tutorials on the topic. Much of the instruction existed of passive reading or tutorials that could

have been designed to motivate and engage students better. Also, many existing tutorials may be too technical for less advanced students.

Target Audience

The target audience for this web-based instruction is beginning and intermediate web design college students. The tutorials are separated into a beginners section on the website and an intermediate section on the site. The beginners' tutorials are targeted at students who have none to intermediate knowledge about web design and/or accessibility. The intermediate tutorials are designed for students who have experience designing websites and want to test their designs for accessibility or to apply universal design principles. Therefore, the characteristics of the target audience are college students at the start of their education in the career of web design. The age of these students is likely 19-24 years old. The introductory tutorials would be most effective with freshman and sophomores, while the intermediate tutorials would be better suited to juniors and seniors who have already taken the introductory courses. Older or returning students, even those with some real world experience, might benefit from the tutorials as well. Since the course is completely online, distance learners as well as those in the classroom could use it depending on the instructor's needs. The course is designed to need little or no outside instruction beyond the tutorials for an introduction to the topic.

The situation characteristics of the target audience therefore involves students who are learning website design in a required degree college course and plan to enter the career field of web design/development. Decision related characteristics for this project included a college curriculum and instructors who desired an addition to the course lessons covering web accessibility in more depth than currently covered. The needs analysis was conducted with students from two courses in the web design degree emphasis at a state university to determine the appropriateness of the learning to the target audience. Learner characteristics of the target audience include students with pre-requisite learning in building a basic website with images for intermediate students and little or no knowledge needed for beginning students. Other learning characteristics that are useful

for those taking this instruction include a willingness to learn new skills to add to existing skills and an open-minded attitude towards designing for all users or designing universally, taking into considering the needs of the disabled when creating aspects of a website.

Culturally, the tutorials are designed to meet the standards for accessibility in the United States and to comply with the ADA, 504 and 508 laws. The standards encouraged in the tutorials are standards embraced by the W3C (Worldwide Web Consortium), an international group created to ensure consistent standards for website design. The standards apply to all websites designed for increased accessibility and in the application of universal design.

This instruction is also designed to accompany current web design curriculum and enhance the study of the development of websites or to be used as a stand-alone study primer for students.

Literature Survey

Common Website Accessibility Problems

The field of web design is constantly changing. Current websites often contain a variety of images, multimedia and interactive components. While these make sites exciting and engaging for users, they can be problematic for those with disabilities. A few of the common problems with website accessibility include:

- Colorful and informative images are important for users to engage them in a website. Images without alternative text or with alt text that is not descriptive enough are useless to those who are blind or have sight impairments. An example would be the alternative text “image 1, image 2, etc” that tell the impaired user nothing about the images’ content
- Use of video or multimedia components (flash animations, etc) without captioning the video or providing an alternative text-only version

- Use of narration that is vital to the understanding of content material without a text or graphic equivalent for the hearing impaired
- Use of non-descriptive links such as “click here” Again meaningless to the sight impaired
- Careful consideration not taken of contrast in text and background color for readability or for those with color blindness
- Inclusion of options for enlarging text, turning on or off audio, or zooming in can also increase site accessibility
- All content, including all interactive or multimedia content that is important to conveying the meaning of a site, must be able to be navigated by the keyboard not just by the mouse (Hudson, 2010)

Designer and Developer Attitudes Towards Accessibility

Web professionals need to know either how to make these components accessible or if an alternative option should be provided for the disabled. College students studying web design should be taught how to use the accessibility options available in the software used to create websites and multimedia components. They also need to be able to test their creations for accessibility and also where to search for resources for future developments in the career field in regards to accessibility.

Some designers may need to have long held beliefs and attitudes about the need to make their websites accessible or universally designed changed. The designer of this project, in her work as a teaching assistant, observed two beginning multimedia students discussing making websites accessible. Both said they felt is was often too costly and in some cases unnecessary to make sites fully accessible.

“Though estimates vary, most studies find that about one fifth (20%) of the population has some kind of disability. Not all of these people have disabilities that make it difficult for them to access the Internet, but it is still a significant portion of the population. Businesses would be unwise to purposely exclude 20, 10, or even 5 percent of their potential customers from their web sites. For schools, universities, and government entities it would not only be unwise, but in many cases, it would also break the law.” (WebAIM, 1999-2010)

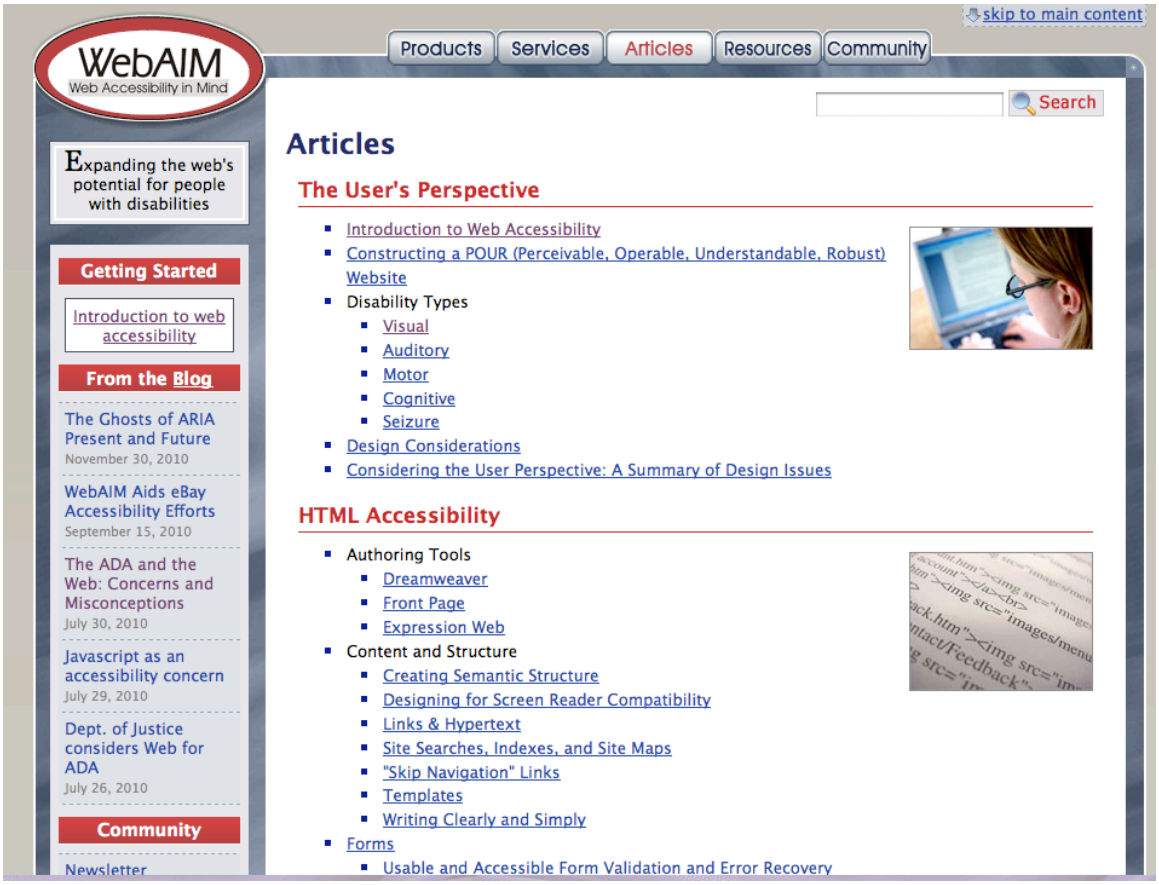
While there are some multimedia components that cannot be made completely accessible, it does not take long or cost much to provide an alternate text or audio file for the disabled to obtain the content. Also, while it can sometimes be costly to redesign a site for accessibility, it is not so when a site is designed from the start with accessibility in mind. "Sometimes web developers fear that it is more expensive and time-consuming to create accessible web sites than it is to create inaccessible ones. This fear is largely untrue. The benefits of providing access to a larger population almost always outweigh the time required by a knowledgeable developer to implement that accessibility." (WebAIM, 1999-2010) This shows that some students need to be taught the reasons accessibility is important and be given positive reinforcement for designing accessible websites. The lawsuits may be compelling the industry to act regarding accessibility, but students studying web design should cultivate an attitude that it is not only legal but also ethical to make the sites they create as accessible to as many users as possible. Primarily it is true that most professional web developers "…are not opposed to the concept of making the Internet accessible to people with disabilities. Most accessibility errors on web sites are the result of lack of awareness, rather than malice or apathy." (WebAIM, 1999-2010) Starting new web design students on the right path to accessible website designing while in school, will help make sites in the future more accessible to more people.

With each new version of web and multimedia authoring software, the tools and options for accessibility improve. Students studying to become web designers and developers should be taught current accessibility features as well as be prepared to implement new features in the future.

Current Accessibility Education

Current online resources and/or tutorials for teaching web accessibility often are passive reading activities with little opportunity for the user to test their knowledge or practice their skills. One of the most useful online instructional materials for website accessibility is WebAIM, Web Accessibility in Mind (http://webaim.org/articles/). This site is fairly comprehensive and covers many of the necessary topics for web developers regarding

accessibility. The site is primarily text with some photos so it provides a good resource but represents a passive instructional strategy. It also contains a great amount of information on each page that the learner must wade through to get the basic message of the instruction.



Another useful online instruction for web accessibility that follows a more typical online tutorial format is the W3C Web Accessibility Initiative (http://www.w3.org/WAI/wcag-curric/).

This site is a strong resource for web accessibility guidelines but has not been updated since 2000. While the basic code examples are still accurate, many new web accessibility challenges have emerged since this site was last updated, such as more usage of interactive media and new scripting languages (HTML 5 and CSS3).

The project designed for this instruction is different from the above examples in the following ways. Firstly, it is updated to include the latest information available on the topic of web accessibility and includes a study of universal design principles in conjunction with web accessibility. Secondly, it is not meant as an exhaustive resource on the topic but as a quick study program for college students to get the main concepts and then be directed to resources for further study. Therefore, the technical details and textual information is minimal and the focus is on testing student knowledge of the basic concepts that are being introduced. It also provides some interactive sections for students to practice web accessibility with the tools available to them such as web browsers and web development software. Lastly, it seeks to engage and motivate the student to learn through the use of graphics, video, interactive simulations and games, and checkpoint questions to test what they have learned.

SOLUTION DESCRIPTION

Goals of the project

- Gain an understanding and awareness of accessibility and how it relates to the career field of web design and development
- Learn methods to create more accessible websites
- Learn ways of testing websites and multimedia projects for accessibility

Performance objectives

Each tutorial has its own performance objectives.

Performance objectives for a sample tutorial:

An Introduction to Accessibility

- Define the term “web accessibility” based on the definition provided in this tutorial.

- Name five disabilities, mentioned in this tutorial, that are addressed by web accessibility
- Use the ADA and/or 504 and 508 laws to explain the legal reasons websites must be made accessible
- Name the retail chain that was sued on behalf of the blind and state why this was an important lawsuit for web accessibility.

The following are titles for the other five tutorials in the prototype. Each has its own set of performance objectives.

- All About Alt Tags
- Look Ma, No Mouse. Navigation Essentials
- Test Your Site. Accessibility and Usability
- Accessibility Meets Universal Design Principles
- What's Next? Future of Accessibility on the Web

Instructional Strategies

The instructional strategies decided upon for this project addressed two learning domains and referenced Gagne's nine events of instruction learning theory.

The learning domains addressed include:

- Cognitive – Students are able to define terms and identify concepts after instruction.
- Affective – Students have changes in attitudes about the importance of web accessibility after instruction.

A learning theory at work in these web-based instructional tutorials are Gagne's nine events of instruction as they are designed to engage, instruct, provide practice, and give feedback.

The instructional strategies more specifically include:

- Objectives stated at the beginning of each tutorial so students are clear on the goal of the tutorial.
- Interactive feedback in the form of checkpoint questions at the end of each new section of material.

- Screenshots and screen recordings to help the student visualize and follow along with the instructions.
- Narration accompanying text on screen for both audio and visual stimulus.
- Short interactive section in each video for students to practice the skills taught.
- Engaging use of graphics throughout to stimulate thinking.

Examples of each of the instructional strategies above used in Tutorial 1: An Introduction to Accessibility or in other tutorials:

- Page 1 of each tutorial states what students can expect to learn (objectives)
    - What does "web accessibility" mean?
    - What types of disabilities are addressed with web accessibility?
    - What are the ADA, 504 and 508 laws and how do they relate to web accessibility?
    - What large retail chain was sued due to a problem with accessibility on its website? Why was this an important event for web development and accessibility?
- Following each page of instruction is a confidence check question directly relating to that section. The student clicks on the answer and is sent to a page with feedback as to the correctness or incorrectness of the answer. Example of a question following the section on types of disabilities addressed by web accessibility:
    - You are designing a web tutorial on how to build a model airplane. Only images are being used to visually explain the process and you decide not to do a text equivalent version. Is your site fully accessible by the blind?
        - A. Yes, it is fully accessible by the blind.
        - B. No, it is not fully accessible by the blind.
        - Correct Answer: B. Feedback on both the correct and incorrect answer is the same, providing the correct answer to those who answered incorrectly and additional information to those who answered correctly.

        - Example feedback for this question: This site is not accessible by the blind or those with other visual impairments. If images are the only way to understand how to build the model airplane using this website, a blind person will want to find another site that provides text explanations or alternative text for the images (called alt tags - you will learn about these in Tutorial 2)
- Screenshots and/or screen recordings are used for students to follow along or to interact with and practice accessible design. Example is in Tutorial 4 on testing web accessibility where students are asked to practice using a web accessibility toolbar to turn off images in a browser to check for alternative text.
- All text on screen in all tutorials is narrated. This allows for accessibility and for audio learners and visual learners to both be accommodated.
- Interactive sections are part of the screen recordings mentioned above.
- Appropriate graphics are added throughout the tutorials to aid in learning. For example background images related to the text such as a picture of an eye when talking about visual disabilities in Tutorial 1.
- Layout and design is consistent throughout all the tutorials to ease student use and understanding.

Media Components

This project is an online web-based instruction. Media components include:

- Dreamweaver software, HTML, and CSS scripting for the website structure and pages. Navigation links are designed to allow the student flexibility in learning and the ability to revisit previous sections in the tutorials if desired.
- Mac OS, Quicktime 10 and IMovie, and Captivate software for screenshots, screen recordings, editing video, captioning, and interactive video.
- Internet and browsers for instruction in testing accessibility and usability of websites, allowing students to practice concepts learned.
- Garageband and/or Captivate software for narration and audio.
- Isight camera or video camera for interviews or additional footage.

Challenges Overcome

This project presented challenges for its designer. The most difficult was the short amount of time for construction of the tutorials as well as time for evaluation and testing. Secondly, sticking to strong performance objectives and not allowing the tutorials to become off topic was a challenge. Thirdly, the incorporation of interactivity was difficult as the designer lacks skills with the software being used for the interactivity. Lastly, ensuring that each tutorial is of sufficient length to meet the project requirements was challenging due to each student being allowed to progress through the tutorials at their own pace.

These challenges were met in the following ways:

- A strict timeline with deadlines was followed as much as possible to ensure enough time for both construction and testing.
- Tutorials were checked and rechecked for topic appropriateness and to ensure meeting of performance objectives.
- Use of Captivate or Flash software for media components was limited to short interactive sections of each tutorial with additional interactivity coming from HTML based questions and feedback pages.
- Length of tutorials was tested during usability testing to determine appropriate length.
- Tutorials were tested for accessibility using the methods endorsed in the tutorials so they are good models of accessibility and meet legal standards for inclusion in college programs.

METHODS/PROCEDURE

Project Narrative

This project has undergone multiple changes in its scope, its intended audience and its objectives since it was undertaken. The project was originally intended for incorporation into a specific university curriculum. It has now been expanded to be more inclusive for all college students studying web design and development.

The project was originally designed to be a web-based site containing Captivate designed videos. Due to difficulty on the part of the designer to gain the necessary skills with the Captivate software and problems with incorporating the necessary accessibility needs of the project, the designer made the choice to increase the web-based portion of the project, which she has strong skills in, and limit Captivate components to the more interactive sections of the tutorial. This allowed the project to move forward at a more rapid pace while still keeping to the requirements necessary in the project. The designer of the project used her considerable design skills to create an engaging, user-friendly, and informative web-based series of tutorials. Interactive sections, while not the largest parts of the site, are well designed and helpful to student learning. Accessibility was addressed by providing alternative text versions for these Captivate components.

Each tutorial was designed using Dreamweaver software to create the website that houses the tutorials as well as the tutorials themselves. Videos, such as screen capture recordings, external videos, and interactive Captivate videos were incorporated into the website where appropriate. Each tutorial contained its own navigation, separate from the main navigation, so that students may have the option of following the tutorial linearly and then returning to specific pages if so desired for further review. Each tutorial states the learning objectives at the beginning for student review.

This design allows the student more freedom to revisit areas they feel they did not fully understand if for example, an instructor in the classroom uses it as a precursor to a quiz. This design style does have the drawback of allowing the students to move non-linearly through the tutorials, but the designer decided to encourage the students to follow through each tutorial page by page through engagement with the material rather than impose a completely linear format.

On each page in the tutorial there is a text section with information related to the subject matter for that section. Accompanying the text is an appropriate image, a screenshot, video and/or link to an interactive activity.

Also on this page is a question directly related to the subject matter covered with clickable answers below the question.

After clicking their answer, the student is provided feedback for their answer. This is used as a checkpoint for the student to see if they understood that section. At the end of each tutorial is a summary page that briefly summarizes all of the instruction in that tutorial.

Also included in the website is a resources page if the student would like to learn more beyond the tutorials. All components including website, tutorials, videos, narration, graphics, and any additional parts were designed, constructed and/or obtained by the designer of the project.

Difficulties encountered in this project were primarily due to the large scope of the project undertaken by the designer in a very limited time frame to complete the work. The designer realized that the scope was most likely too large to complete alone in the time allotted for the project. Additionally, the designer suffered from serious health problems that led to hospitalization during the production that delayed work on the project further. The designer resolved the delays in production time by scaling the project back to a scope that was more reasonable for the time left to complete the work. The original plan of six tutorials was scaled back to two with the designer choosing to complete Tutorial 1 and 4 at this time.

An additional problem that needed to be resolved was the need for increased interactivity and the designer's inexperience with the Captivate software being used for this part of the project. This problem was resolved by using the Internet, textbooks and other resources to gain the skills needed to complete the project using the Captivate software.

RESOURCES

Materials Used

- Time – very limited time to complete project, project scope modified to meet time constraints
- Budget – limited to software that needed to be purchased beyond what the designer already possessed. (Quicktime pro, Captivate for interactive videos, final report printing) Budget Total: Approximately $300.00
- All other hardware and software needed (listed under media components) was already available to the designer

- Any external expertise or training was accessed by the designer from Internet sources, books, or contacts available to the designer

Technical Skills Needed

As stated above, the designer is technically skilled in the majority of skills needed to complete this project. Additional skills were gained, as needed, through Internet sites, books owned by the designer, or designer's contacts.

TIMELINE/PROGRESS REPORT

This project began in June 2009 and the first stage of the project was completed in December 2010. The designer plans to continue working on the prototype after the intitial phases are presented until it is complete.

Milestones Checklist

- **Design phase 1** – June 2009-August 2009
  - Topic chosen and target audience identified
  - Instructional Design Document Needs Analysis section written
- **Design Phase 2** – September 2009-December 2009:
  - Needs Analysis survey conducted with target audience, Needs Analysis section of IDD revised to include survey data
  - Revised IDD with additional sections added
  - Design and intital production of Tutorial 1 completed
- **Design Phase 3** – Febuary 2010-May 2010
  - Final IDD completed
  - Website structure completed including navigation
  - Web banner graphic completed
- **Design Phase 4** – June 2010-August 2010
  - Intial content gathering and research completed

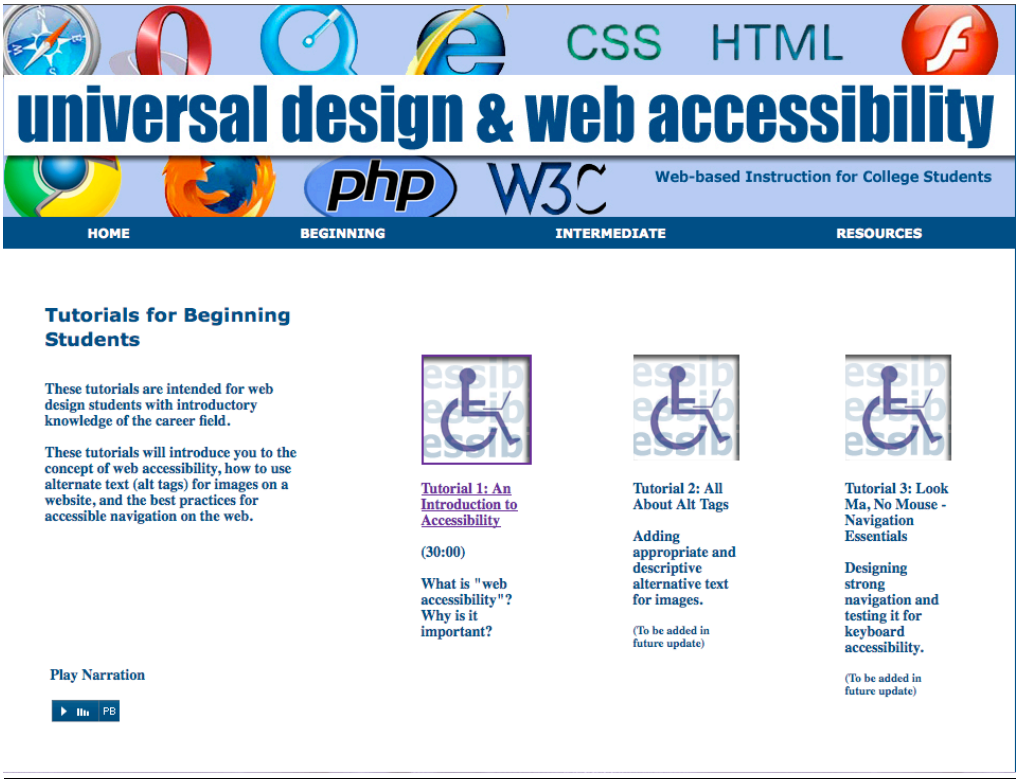
  - Modification to project due to unforseen delays (change in format to more web-based, number of tutorials to be completed in intitial work plan reduced from 6 to 2).
  - Timeline modified to accommodate changes.
- **Design Phase 5** – September 2010-November 2010
  - Tutorial 1 completed (including audio narration, video components, question feedback components)
  - Tutorial 4 completed (in addition to similar components to Tutorial 1, Captivate interactive vidoes included)
  - Summative and Formative evaluations of Tutorial 1 completed with target audience (November 15, 2010)
- **Design Phase 6** – December 1, 2010-December 16, 2010
  - Resources page added to website
  - Introductory movie for home page completed
  - Summative and Formative evaluations analyzed
  - Final report written and printed
  - Presentation prepared
  - Project presented (December 16, 2010)

Major Deliverables

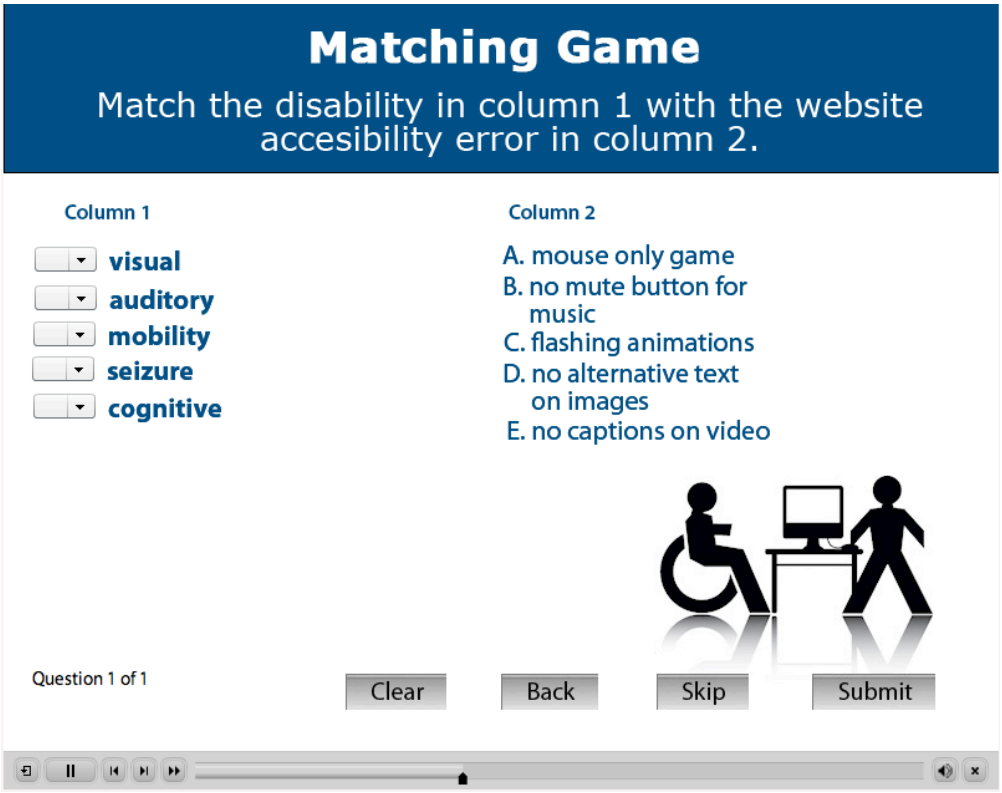
- Website with two of six interactive tutorials complete.
- Testing and evaluation (summative and formative) completed on the website and on one Tutorial
- Final Report
- Final Presentation
- CD with project files and documentation

The following pages show screenshots from the website and the two completed tutorials.

Home Page (pictured here during production)



Landing page for Beginning Student tutorials



Matching Game – Confidence Check from Tutorial 1

Sample screen recording from Tutorial 4

EVALUATION/TESTING RESULTS

Testing Procedure

Evaluation and testing of the project was conducted on November 15, 2010. A pre-test and post-test was used to evaluate the effectiveness of the instruction and a survey was conducted along with an in-person feedback session to evaluate the usability of the project. The evaluation was conducted with the target audience of college students in a web design course at California State University Monterey Bay. The sample size of the group was 17 students. The website and Tutorial 1:An Introduction to Accessibility were tested with this group. While this was a more advanced group of web design students than this tutorial was originally designed for, it was tested due to its more advanced stage of production at the time of the scheduled testing.

Results of the evaluation and testing are detailed in the next section and copies of the testing materials can be found in the appendix. The pre-test and post-test consisted of the same ten questions directly related to the material in the tutorial. Students were given the pre-test to complete and then when all students had completed it, they were given permission to begin the tutorial. The designer instructed the students to read through the home page, the beginners landing page for the tutorials, and then click on the link to begin tutorial 1. The students were also instructed to follow the prompts on screen through the tutorials. No other instruction was given so that students could explore the features of each tutorial without additional information.

After each student had completed the tutorial they were given the post-test to complete and the formative survey to fill out. The time needed to complete the tutorial varied by student but was approximately a minimum of 10 minutes and a maximum of 25 minutes. The designer observed the students while they used the project and took notes of the students' progress. When all students had completed the tutorial, the designer conducted

a 15-minute in-person feedback session on the usability of the project. All tests and surveys were analyzed. The results are as follows.

Summative Evaluation/Effectiveness of Instruction

The designer of this project believed that the instruction would be most effective with a beginner group of web design students. As this was a more advanced group, the designer was unsure of the effectiveness of the instruction, but believed that the instruction would still be effective for the students. This assumption was based on discussions with the instructor of the course, who felt that the tutorial would be of value to his students.

Therefore, the null hypothesis was in the positive direction due to this assumption of the instruction being effective. The following table shows the pre and post-test scores of the students. The results are out of a 10-question quiz. A paired sample t-test was run on these scores using a one-tailed distribution and with a pre-set alpha level of 0.05 for the test.

	Pre-Quiz	Post-Quiz		Pre-Quiz	Post-Quiz
Student 1	8	9	Student 13	8	10
Student 2	8	9	Student 14	9	8
Student 3	6	10	Student 15	9	10
Student 4	10	10	Student 16	9	10
Student 5	8	10	Student 17	7	10
Student 6	7	10			
Student 7	9	10			
Student 8	8	10			
Student 9	8	10			
Student 10	9	10			
Student 11	8	9			
Student 12	6	9			

The paired sample t-test returned a p-value of 0.000335979. This shows a significant finding, as it is much lower than the pre-set alpha of 0.05 used for the test. This indicates that the intervention was successful in teaching the subject matter.

The next step in testing would be to test this tutorial with students that have less advanced web design skills to see if the same results can be yielded or not. In any case, the findings of this first test are encouraging that the instruction is effective with the target audience.

Formative Evaluation/Usability

The instruction was followed by two methods of feedback on usability. One was a survey that ascertained the students' opinions about the design and usability of the instructional tutorial/website. This survey was then followed by an in-person feedback session with the designer. Eight questions on the survey asked the student to choose one of the following in response to a statement about the tutorial: Strongly Agree, Agree, Disagree or Strongly Disagree. The last four questions asked the students for suggestions and comments. The following table shows the first eight questions and the results. (Number represents how many students out of 17 chose this answer on the survey)

	Strongly Agree	Agree	Disagree	Strongly Disagree
I feel the tutorial increased my knowledge of the material.	3	13	1	0
This tutorial was interesting.	5	12	0	0
The images and graphics were helpful in aiding my understanding of the material.	7	8	1	1

	Strongly Agree	Agree	Disagree	Strongly Disagree
The tutorial instructions were clear.	7	7	2	0
The tutorial was easy to use.	8	9	0	0
The quiz questions were based on the material in the tutorial.	15	2	0	0
The narration aided my understanding of the material presented on screen. (Please skip this question if you did not use the narration feature.)	5	4	0	0
I would be interested in using other similar tutorials on this topic.	4	10	3	

Analysis of the results of this part of the survey: The above table shows that a majority of the students felt the tutorial increased their knowledge of the material, was interesting, the graphics were helpful, the instructions were clear and it was easy to use. Most felt the questions asked on the pre-and post quiz were directly related to the material and this corroborates the validity of the summative results. Only 9 students chose to use the accompanying narration and they were closely split on its usefulness in aiding

understanding. Finally, most of the students felt they would be interested in using a similar tutorial on other similar topics.

These results show fairly conclusively that the tutorial was successful from a formative standpoint. However, some students did disagree with some of the above statements and those areas should be examined to see if they could be enhanced. Also, more tests should be conducted with a less advanced group of college students to see if similar results are achieved.

Next the students were asked the following 4 questions requesting user comment and suggestions. The most often mentioned suggestions are presented here.

- Provide any suggestions for improving the functionality of this module: (For example: Was there anything that did not work or was frustrating to use? etc.):
    - The continue button was confusing to many students because it was on every page and many students mentioned that they could skip the confidence check question if they wanted to. Sample suggestion: “No continue button, just answer the question to continue. I skipped the answering portion the first time. “
    - The slide navigation at the bottom was mentioned as needing labeling or the slides needing to be numbered so it would be easier to navigate to the correct slide.
    - Students who used the narration wanted more options such as rewind and fast-forward.
    - The captivate matching game was mentioned by one student as needing to have the labels closer to the correct columns so it was easier to understand.
- Provide any suggestions for improving the look and feel (graphics, colors, etc.) of this module:
    - Most students felt that the graphics were well done and enhanced the information in the module. Most mentioned possible changes included: font size, and a graphic way, such as an arrow, to direct attention to answering the question on the slide. Sample comment: “Very clean and

pleasing. Actually explained the mechanics – a visually impaired person can't read the text…Good module!"

- Provide any suggestions for improving or adding to the content of this module:
  - Most students felt the content was just the right amount. Only improvement mentioned was to have references to back up the legal information presented in that section of the tutorial.
- Any other additional suggestions or comments?
  - Most students left this question blank. There was some mention of a few misspelled words in the tutorial. Also, a student especially liked the matching game and would have liked to see more of those in the tutorial.

The designer and the students then participated in a 15-minute feedback session where students were able to expand upon their opinions given in the survey. Additional suggestions/comments beyond what has already been mentioned above included: more fun mini-games, really liked the video content, the module was pretty straightforward, felt the narration was only beneficial for the hearing impaired as no additional information was provided in the narration that was not on screen, so that should be mentioned so users know before they start, and the testing process was easy to follow.

In addition to the above information, the designer was able to observe the students as they progressed through the module. The students who finished quickly did not seem to listen to the narration. Students who took more time listened to the narration and watched the videos all the way through. There was some confusion over how to play the matching game and also where the first tutorial started. The time to complete the tutorial ranged from 10 minutes to 25 minutes. The designer also noticed some graphic design flaws with text placement while observing the students using the tutorial.

CONCLUSION

In summary, this project is a web-based instruction including a series of six tutorials (two completed at the time of this report's writing) on the topic of web accessibility and universal design. It incorporates text, graphics, video, audio and interactive instruction to

give the student a basic understanding of the topic as well as teaching practical skills for testing a website for accessibility. The target audience for the instruction is college students enrolled in web design courses. The tutorials can be used as stand-alone instruction or as part of a college curriculum. They are not meant as an exhaustive resource but as a primer for further study. Resources and references are provided for students to continue their study of the topic.

While working on this project the designer has increased her understanding of instructional design and how to create projects that are not only useful for learning but engaging and easy to use. She has also enhanced her graphic design skills and added many technical/coding skills to her skill set. Also, informative was the opportunity to conduct usability testing for the website. It was interesting to see the project through the eyes of students who had not used it before and have them provide very helpful suggestions and ideas to improve the project. The usability testing was helpful in identifying problems not considered by the designer during the production process. The designer also gained more knowledge about web accessibility than she knew at the beginning of the project.

The future of the project is up to the designer and her potential client for the project. The designer would like to continue working on the tutorials until they are all complete so that her client, a university professor teaching website design courses, could use them in his classroom as a valuable tool. The designer would also like to conduct additional usability and summative testing with other members of the target audience, including beginning web design students and would like to test the more advanced tutorials, when complete, in the same class used for Tutorial 1's testing.

The designer's advice for anyone who would like to create a similar project is as follows. Dedicate more time to a project this large and detailed. If you are going to hand code or incorporate similar highly technical components for the project, know those skills beforehand or work in a team with others to complete the project quicker. This project was overwhelming at times for the designer working on it alone. Another piece of advice

would be to consider how to develop the interactivity into your project much more during your planning phase so that this technical hurdle does not slow down the project. For the testing of the project, the designer would advise having a variety of testers available so that each tutorial can be tested with the most appropriate users for that tutorial. Overall, with a strong team, a long enough timeline to incorporate the most interesting and engaging interactive components, and a passion to teach the topic; this project could be made into something useful not just for the target audience but for many users who are not aware of the importance of web accessibility design.

In conclusion, this project provides an opportunity for students to explore the topic of web accessibility and universal design at their own pace as well as explore the topic further on their own using the provided resources. The designer has a passion for teaching the topic and believes that this project contributes important instruction for future website designers and developers. She also has enjoyed the process of designing, producing and testing this project. She was excited to see it used by students in the college classroom during testing and hopes to see it used for future students.

REFERENCES

Hudson, Roger. (2010) *Ten Common Accessibility Problems.* Retrieved September 28, 2010 from http://www.dingoaccess.com/accessibility/ten-common-accessibility-problems/.

WebAIM. (1999-2010) *Introduction to Accessibility.* Retrieved September 28, 2010 from http://webaim.org/intro/.

http://www.w3.org/WAI/wcag-curric/

APPENDIX

Complete Pre and Post Test

Please write an "X" next to the your answer.

Name _____

Q1) The term "web accessibility" refers to making websites that are accessible by users of all abilities and disabilities.

___ a) True

___ b) False

Q2) Which of the following is considered poor accessibility on a website for a person with a vision disability:

___ a) Too many colorful images on the website.

___ b) Images on the website without alternative text descriptions.

___ c) No images on the website.

Q3) Which of the following is considered poor accessibility on a website for a person with a hearing disability:

___ a) Video without captions or text equivalent document.

___ b) Loud music playing on the website.

___ c) Narrator with a high-pitched voice.

Q4) Which of the following is considered poor accessibility on a website for a person with a mobility disability:

___ a) A portion of the website's navigation can only be accessed using a mouse.

___ b) The website's navigation links are in a small font size.

___ c) The website's navigation is at the bottom of the web page.

Q5) A website with flashing buttons or fast moving animations could be considered to have poor accessibility for people with seizures.

___ a) True

___ b) False

Q6) A website has music playing in the background when the user comes to the site. A button is provided to mute the music. This is an example of good accessibility for people with cognitive disabilities.

___ a) True

___ b) False

Q7) Screen readers are accessibility tools that help people with which disability:

___ a) hearing

___ b) vision

___ c) mobility

Q8) The Americans with Disabilities Act (ADA) and the laws 504 and 508 have been applied to lawsuits against both federally funded and commercial websites that are not accessible.

___ a) True

___ b) False

Q9) Which retail chain was sued for not having a website accessible to the blind?

___ a) Walmart

___ b) Macy's

___ c) Target

Q10) The above lawsuit was important in terms of web accessibility because:

___ a) the website did not have to be made accessible because the blind lost the lawsuit.

___ b) it was the first major lawsuit to apply web accessibility laws to a commercial website.

___ c) the lawsuit did not proceed because the retail chain's website was proven to be accessible.

Complete Evaluation Survey

Evaluation Survey – Tutorial 1:An Introduction to Accessibility
Please write an "X" next to your answer.

Name: _____ (optional)

Browser used to view tutorial: _____

1. I feel the tutorial increased my knowledge of the material.

   ____ a. Strongly Agree
   ____ b. Agree
   ____ c. Disagree
   ____ d. Strongly Disagree

2. This tutorial was interesting.

   ____ a. Strongly Agree
   ____ b. Agree
   ____ c. Disagree
   ____ d. Strongly Disagree

3. The images and graphics were helpful in aiding my understanding of the material.

   ____ a. Strongly Agree
   ____ b. Agree
   ____ c. Disagree
   ____ d. Strongly Disagree

4. The tutorial instructions were clear.

   ____ a. Strongly Agree
   ____ b. Agree
   ____ c. Disagree
   ____ d. Strongly Disagree

5. The tutorial was easy to use.

   ____ a. Strongly Agree
   ____ b. Agree
   ____ c. Disagree
6. ____ d. Strongly Disagree

7. The quiz questions were based on the material in the tutorial.

   ___ a. Strongly Agree
   ___ b. Agree
   ___ c. Disagree
   ___ d. Strongly Disagree

8. The narration aided my understanding of the material presented on screen. (Please skip this question if you did not use the narration feature.)

   ___ a. Strongly Agree
   ___ b. Agree
   ___ c. Disagree
   ___ d. Strongly Disagree

9. I would be interested in using other similar tutorials on this topic.

   ___ a. Strongly Agree
   ___ b. Agree
   ___ c. Disagree
   ___ d. Strongly Disagree

10. Provide any suggestions for improving the functionality of this module: (For example: Was there anything that did not work or was frustrating to use? etc.):

11. Provide any suggestions for improving the look and feel (graphics, colors, etc.) of this module:

12. Provide any suggestions for improving or adding to the content of this module.

13. Any other additional suggestions or comments?

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