Examining the Perceptions of People with Disabilities on the Use of Accessibility Standards in Web Interface Design

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Abstract— **This paper focuses on how a small sample of people with disabilities perceives the usability of web interfaces designed to meet current standards for people with disabilities. Developing accessible interfaces for online educational tools is necessary in providing an inclusive learning environment. Seeking the perceptions of people with disabilities is a logical design step, but it is even more critical due to the emerging evidence on the limitations of Web Content Accessibility Guidelines (WCAG), the standard currently used in the design process. In this work, we report the perceptions of people with disabilities on an example web interface designed according to WCAG standards. In this work-in-progress, we employed 43 workers from Amazon Mechanical Turk to compare the existing interface for CATME (an educational platform for team formation and peer evaluation) to an interface implemented according to web content accessibility guidelines while giving why they might prefer the features of either interface. The majority of the participants preferred the WCAG-compliant designs, a few participants provided useful reflections on their preference for the original interface. For example, WCAG criteria 1.4.11 require that hovering over a button results in a color change of the button from blue to white. Approximately half of the participants supported this feature, but the rest preferred a different method of highlighting a target button. We infer that WCAG criteria should be followed with continued reflections on user-centered design, particularly given that several WCAG criteria apply on a case-by-case basis according to the overall design of the web interface. In this paper, we perform a detailed analysis on the feedbacks and reasons given by the participants on the implementation of various accessibility criteria and examine their reasoning to understand the rationale of this small sample of people with disabilities in web designs. The input from this study will guide further exploration with a larger sample of participants. We hope that our research findings will provide further insights into the development of accessible educational tools.**

Keywords—engineering education, accessibility, user experience

I. INTRODUCTION

Lawsuits that target educational and governmental websites that violate that accessibility standards have become prevalent recently [1]. Due to this very reason, various entities have adopted the "inclusive design" strategies [2][3] in a variety of sectors including housing [4] and transportation [5]. Researchers in the field of user experiences have conducted a wide range of studies from remote usability studies [6] to in-person usability studies [7] to examine the perspectives of people with disabilities when they navigate on web interfaces. For example, Oswal (2019) has proposed a "medical model of accessibility design" to cater to people with disabilities navigating the web [8]. Furthermore, user experience researchers have taken a wide range of steps to re-evaluate the future of accessibility guidelines [9]. Similarly, the prevalence of people with intellectual disabilities [10] further highlight the needs for educational platforms to be accessible to provide equal educational access to all. In view of the pressing need to design for people with disabilities [11], WCAG [12] had emerged to serve as a guide for web designers to follow. Various entities have adopted WCAG in designing their web interfaces, including CATME [13]. CATME is a peer evaluation tool used by instructors across the world to access the performance of team members in a team setting for example in an engineering team. We used CATME as our example web interface for this study as the CATME team has spent 2 years researching and redesigning the CATME web interfaces to fulfill the standards of WCAG 2.1. To validate the WCAG criteria [14][15], user experience researchers have conducted usability tests to access the effectiveness of the web designs designed according to WCAG criteria. Thus, our research questions are the following: Does the CATME website designed according to the WCAG criteria fulfill the needs of the people with disabilities? What are the perceptions of the people with disabilities in regard to CATME website designed according to the WCAG criteria? Do they prefer the CATME web designs that violate WCAG criteria or do they prefer the ones that adhere to WCAG criteria?

II. METHOD

We employed 43 participants with various disabilities on Amazon Mechanical Turk in this study to seek their thoughts about our web interface designs designed according to Web Content Accessibility Guidelines (WCAG). The goal of the study is to get a broad overview of the perceptions of people with disabilities in regard to CATME accessible web interface. We define people with disabilities in the study as a person who possesses complex medical disabilities, physical disabilities and mental disabilities. As such, participants are not required to mention the type and level of disabilities they are having. The demographics of the people that we employed consisted of both men and women ranging from 18 to 60 years old. There were 21 females and 22 males responded to our survey. We gave them the option to choose their preference towards designs designed according to Web

Content Accessibility Guidelines (WCAG) or existing designs that violate Web Content Accessibility Guidelines (WCAG) or neither. To avoid a bias toward the accessibility standards, we blinded whether the designs were designed according to Web Content Accessibility Guidelines and allowed them to pick their preferred designs. To ensure the reliability of our results, we only employed Amazon Mechanical Turk workers who have a "hit rate" of 90% and above. According to Amazon Mechanical Turk, "hit rate" is defined by the proportion of completed tasks that is approved by requesters [16]. The higher the hit rate, the more experienced the Amazon Mechanical Turk participants are in completing tasks diligently and carefully.

We gave the Amazon Mechanical Turk workers 3 tasks as attached in the appendix. The first task is to evaluate the "add question" functionality (color changes to white or remains blue upon button clicks) on the CATME webpage, the second task is to evaluate the usefulness of the link explanation to the word "sex" on the webpage (shows "what is your gender?" upon hovering on the link "sex"), the third task is to evaluate the usefulness of the error messages on the webpage (the error messages appear in red background and text font in black). The first task belongs to WCAG criteria 1.4.11, the second task relates to WCAG criteria 2.4.4, and the third task deals with WCAG criteria 3.3.1. For each of these tasks, we gave the Amazon Mechanical Turk three choices to choose from, the existing CATME user interface design, the CATME user interface designed according to Web Content Accessibility Guidelines (WCAG) and also the choice to the workers choose neither. The workers are required to choose a single option for each scenario and provide the reasoning of their choice.

III. ANALYSIS

For the first task assigned to the workers that examines accessibility criteria WCAG 1.4.11, our data indicates that half (20) of the workers prefer the existing CATME user interface that maintains the existing blue color of the buttons upon hovering, while the other half (21) of the participants prefer the interface designed according to accessibility criteria, which proposed the change in the color of the buttons upon hovering. There were 2 people who preferred neither design citing a personal dislike of both colors. The majority of the workers who prefer the design as it is indicated a preference towards the existing blue color button as a personal preference for the color blue. One participant indicated that the blue button enables him/her to better differentiate between the button and the white background while participants who oppose the change of button color from blue to white indicated that the change in color of the buttons to white signals that the button is inactive. For the second task assigned to the workers that examines accessibility criteria WCAG 2.4.4, roughly 70% of participants (30) indicated a preference towards the WCAG-compliant design, whereas 11 preferred the original design that violates accessibility guidelines, and 2 people prefer neither. In general, the participants preferring the compliant design indicated that the link description is really helpful for them to understand what the link is about. People who decide against the design generally indicate that it poses a design issue where it gets in the way of reading the info or the

explanation seems repetitive. For the third task assigned to the workers that examines accessibility criteria WCAG 3.3.1, up to about 84% of the participants (36) preferred the WCAG-compliant design with the majority of them indicating that the error message is quite helpful for them to know which questions they are missing out on. Only 6 people preferred the design that violates accessibility guidelines, and 1 person preferred neither design. The small number of participants who preferred the existing design that violates the accessibility criteria on error messages seems to surround their reasonings around the fact that they did not like the red color of the error message box.

IV. DISCUSSION

We support the use of Web Content Accessibility Guidelines as a foundation towards the implementation of accessible web interface. Though there are conflicting studies that indicate the limitations of Web Content Accessibility Guidelines, the people with disabilities population seems to be in agreement with the designs proposed by WCAG except in a few circumstances where the suitability of the designs come into play such as the first task assigned to the workers where roughly half of the workers prefer the existing design that violates the accessibility criteria. As portrayed by our results, accessibility criteria need to be evaluated on a case by case basis, and that it needs to be implemented in line with the general user experience methodologies as stated by Aizpura et al. (2016) [17] to accomplish the optimum user experience results for both people with and without disabilities.

V. CONCLUSION

In essence, we still recommend WCAG guidelines as the foundation towards implementing an accessible web interface though there are people who prefer otherwise. However, due to the acknowledged fact that everyone has their own preferences when comes to web designs, which can provide invaluable insights in designing accessible interfaces, we recommend combining user experience studies together with the Web Content Accessibility Guidelines as each website and its needs are different. Therefore, for certain accessibility criteria, we recommend integrating the criteria with user experience studies to achieve a more thorough user experience. For engineers who might already be following WCAG standards in designing web interfaces, we recommend incorporating user testing on top of WCAG standards as the perceptions of the crowd of people with disabilities can be invaluable in designing an accessible web interface to serve all. Future work will include more detailed analysis on how CATME will utilize results from user experience studies combining with Web Content Accessibility Criteria (WCAG) to deliver optimum user experiences for people with disabilities.

Noting that even where the majority of users prefer WCAG-compliant designs, there is a substantial minority that prefer a non-compliant design, it seems likely that no user will be satisfied with all the WCAG-compliant features on any particular web site. Under those conditions, the only way to satisfy the preferences of the most users is to allow the users to select from a list of WCAG-related preferences that

determine which of the WCAG criteria are enforced. Since each WCAG criterion already has descriptive text, the guidelines themselves provide a starting point for creating a preference-setting page as part of the interface. This creates some unfortunate complexity in the back end of the interface design, but it has little impact on the complexity of the user experience, since users who have no preference regarding the WCAG guidelines could simply use the default interface.

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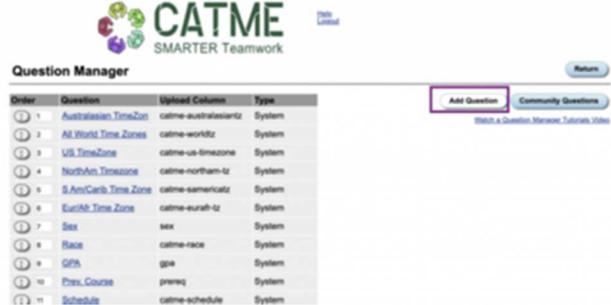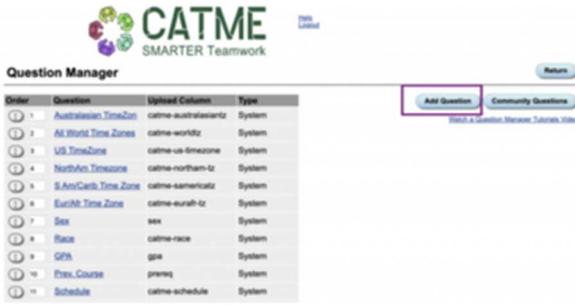
The figure above portrays task 1 where participants are asked to choose which design they prefer.
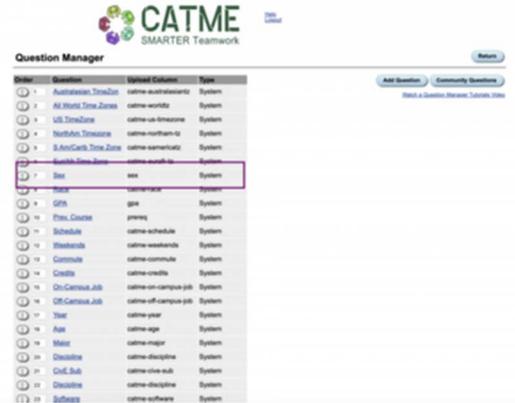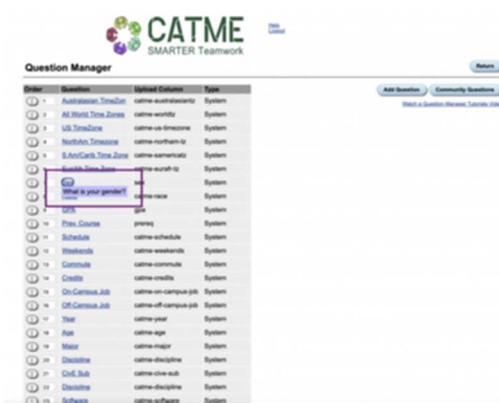
The figure above portrays task 2 where participants are asked to choose which design they prefer.

The figure above portrays task 3 where participants are asked to choose which design they prefer.