International Society of the Learning Sciences

"Accessibility is Important to Everybody": Unpacking Students' Understanding About Accessibility

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Abstract: Existing research on accessibility in computing courses identifies barriers and practices for teaching web accessibility, but little work has been done to leverage students' acquired understanding of accessibility as a meaningful topic of study. In this paper, we use students' assignments to offer insights about what students take away when they learn about web accessibility. Our analysis begins to unpack how students recognize the importance of accessibility, the affordances they associate with it, as well as a considerable willingness to implement accessibility features beyond minimum requirements.

Introduction

From a website's inaccessibility preventing the purchase of necessities such as food ("Another Big Win in the Domino's Pizza Accessibility Saga," 2022) to it inhibiting the completion of a job application (Cahalane, 2018), web accessibility is a social justice issue. Existing work on accessibility in web development courses tends to focus on instructional approaches (e.g., Baker et al., 2020; Putnam et al., 2016; Rosmaita, 2006; Shinohara et al., 2018; Wang, 2012). As such, students' understandings of accessibility are often considered in relation to course or instructor evaluation, rather than its own meaningful topic of study. Research that centers student perceptions and understandings of accessibility provides meaningful insights into structural barriers impacting students' understanding of accessibility, and how instructors and institutions might design courses and programs to better support students' cultivation of accessibility practices (Alonso et al., 2010; Cao & Loiacono, 2021; Conn et al., 2020). Additionally, more research in this area could help expand the conversation around student motivations for learning accessibility (Conn et al., 2020; Putnam et al., 2016; Wang, 2012). Contributing to this important and needed area of research, this paper, which is part of a larger study of accessibility teaching and learning, seeks to answer two research questions: 1) What affordances do students associate with accessibility? In other words, how do students begin to identify all that accessibility offers, and 2) To what extent did students take up supplementary opportunities to implement accessibility features?

Course context

This study was conducted in a large web development course offered as an elective in the Computer Science (CS) department of a large private university in the U.S. The course has an average enrollment of about 150 students ranging across years in the CS major and enrolled students have taken at least two prior programming courses. The course is broad in scope and covers a variety of front-end (i.e., user-facing aspects of a site) and back-end (i.e., components required for dynamic features and functionality of a site) topics. Students work on developing full-stack applications (i.e., websites requiring both front-end and back-end development) and assignments build on each other to create an Instagram-like web application. Assignments consist of labs which are graded pass/fail based on effort and homework assignments are graded on a point-scale according to each assignment's corresponding rubric. Accessibility is embedded in over half of all lab and homework assignments.

Data and methods

The data used for this paper consist of the submissions for three course assignments. Lab 1 is the first assignment students complete in the course and is designed to help them set up their development environments while offering a brief HTML and CSS introduction. Homework 2 and Homework 4 both focus on creating an Instagram-like web application using different technologies: server-side templating and client-side templating, respectively. The three assignments are representative of various accessibility-related tasks including reflections, accessibility testing, and accessibility feature implementation. The data from the three assignments was analyzed using a combination of open coding as well as summative statistics.

Open coding for RQ1: Affordances associated with accessibility

To answer RQ1, we analyzed the responses to two open-ended reflection questions, one from Lab 1 and one from Homework 4, asking about the importance of accessibility. In Lab 1, students responded to "Why, and to whom, is accessibility important?" while in Homework 4, the prompt asked "Do you think that designing for accessibility

also improves the usability of the site for all users? Why or why not?". We grouped the student responses for both questions and free coded for topics.

Summative statistics and open coding for RQ2: Supplementary opportunities

For RQ2, we analyzed implementation details for Homework 2 and Homework 4, which both offered opportunities for students to implement accessibility features beyond what was required to receive credit. In Homework 2, we asked students to "Download the WAVE Extension using either Firefox or Chrome, and use it to generate an accessibility report. Correct as many accessibility errors as you can. Then take a screenshot of your final accessibility report." We also asked students "What corrections did you have to make?".

The WAVE Browser Extension (WebAIM, n.d.-a) is a tool that provides information regarding the accessibility of a webpage by displaying accessibility errors, warnings, and features. Students can click on any of these messages to get more information about what it means and, if it is an error, how to address it. WAVE reports return counts for various categories of issues, including (1) "errors" – indicating failure to include essential accessibility markup tags and attributes in the code, (2) "color contrast" – indicating that the color choices interfere with readability, and (3) "alerts" – indicating potential accessibility issues. We manually extracted the total counts from each student's submitted screenshot and used Microsoft Excel to automatically calculate and plot five number summary statistics to assess the distribution of each. Furthermore, we compiled all the possible errors for each category (see WebAIM, n.d.-b) and assigned codes to the 'alert' category. We used the coding scheme from this list of possible alerts to code students' responses of what corrections they made.

In Homework 4, students were asked to implement three accessibility features that enable users relying on assistive technology to interact with a web application without using a mouse: basic keyboard navigation, screen-reader friendly toggling behaviour, and change of focus for a modal. Students were also given the opportunity to implement an additional feature for extra credit, namely, allowing the 'Escape' key to trigger the closing of the modal while preserving the appropriate keyboard focus. To facilitate grading, students were asked to self-report whether they implemented the extra credit feature. As such, we read through student's submission comments and counted how many of them implemented the extra credit feature.

Findings

What affordances did students associate with accessibility?

One salient theme that emerged from the open coding of students' responses to Lab 1 and Homework 4 was that accessibility benefits everyone— including the students themselves.

Accessibility benefits everyone

Across the responses for both assignments, 62.5% of students wrote about accessibility being beneficial for all users of a website. Below we include an illustrative student response from each assignment:

> Lab 1: "Accessibility is important to everybody. Accessibility dictates the usability of applications across populations, and it is to our advantage that applications are widely available. In addition, a large percentage of the population requires accessible interfaces."
>
> Homework 4: "Designing for accessibility does improve the usability of the site for all users. The screen reader components don't necessarily impact all users, but many may want the option to use the keyboard instead of the mouse only."

Additionally, 74% of student responses included an example to elaborate on or justify how or why accessibility benefited everyone. Some examples shared by students in Lab 1 included: "Making a website accessible may also benefit everyone (e.g., closed captioning used in a crowded bar)" as well as " [Accessibility] leads to better designs and more readable code, and it makes using the site easier and more pleasant for everyone", and some examples from Homework 4 consisted of: "I think all users can benefit from things like alt text (i.e., your browser might be slow one day and images don't load properly)" as well as, "although someone is able to use a mouse, it's just easier given a situation where they would want to tab through the site instead. Another example is color contrast, where although a user might not be colorblind, having a well-contrasted site would just be more visually pleasing."

Accessibility is relatable

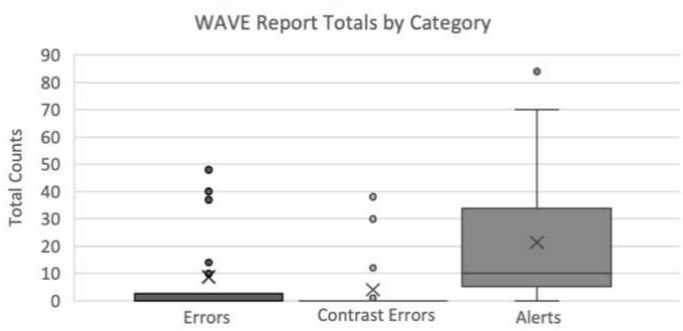
Across both assignments, 20 unique students shared examples of accessibility being beneficial to everyone. Of those, 40% of them gave examples from their own experiences navigating websites using accessibility features. For example, one student shared "it was really easy to just hit enter twice to open and close the modal (and test modal functionality), rather than clicking the "view more button" and then the "close" button. I believe tabbing (and using the enter or space key) can be a useful tool for anyone." In identifying the ease of use that accessibility features— such as tabbing— can provide, students unlock a novel way of navigating and interacting with the web. Interestingly, half of the students who shared similar examples explicitly described these examples as stemming from testing the accessibility features they had implemented for their assignments.

To what extent did students take up supplementary accessibility opportunities?

Students implemented accessibility features beyond those required for credit, which is a strong indication that students *want* to implement accessible websites and when given the appropriate tools, will do so. When given the opportunity to implement an additional accessibility feature for extra credit in Homework 4, over half of all students (54%) implemented it. Implementing the extra credit feature was worth an additional two points for an assignment graded out of 40 points.

Furthermore, in Homework 2, most students corrected all 'errors' and 'contrast errors', while many corrected 'alerts', when the prompt asked for them to "correct as many errors as [they could]". As Figure 1 demonstrates, Homework 2 errors and contrast errors were both tightly grouped around zero, demonstrating that a majority of students were able to correct simple accessibility errors such as empty fields, non-descriptive links, missing alt-text, and low contrast, among others (see WebAIM, n.d.-b).

Figure 1
Student WAVE Report Totals by Category



Despite not being grouped near zero, about half of all students had 10 or fewer alerts. This is likely an indication that students *chose* to address the alerts they received from WAVE, despite not being required to do so— a theory supported by 60% of student reflection responses for this assignment mentioning specific types of alerts they addressed. This evidence suggests that students were motivated to address as many issues as they felt they had the skills to do.

Discussion & implications

As evidenced in this paper, there is incredible richness in how students are taking up the value and importance of accessibility. However, existing research on accessibility focuses on pedagogical practices, interventions, and course design and evaluation (see Baker et al., 2020; Lewthwaite & Sloan, 2016; Nishchyk & Chen, 2018 for in-depth literature reviews on these topics), with little attention given to students' thoughts and practices regarding accessibility. Importantly, while existing work on teaching about accessibility highlights students' and web developers' lack of interest (Putnam et al., 2016) and their disregard for the importance of accessibility (Conn et al., 2020; Putnam et al., 2016; Wang, 2012), the findings presented here offer insights into the many ways in which students value accessibility, and how willing they are to go above and beyond minimum requirements of assigned accessibility implementation. This finding is not only encouraging for instructors who may be feeling discouraged about teaching the topic, it also highlights the need for better understanding how educators can enable and motivate students in this area. For example, while conducting the analysis across student responses for Lab 1 and Homework 4, we noticed a considerable difference in the number of students who recognized accessibility as important and beneficial for all users in each assignment (Lab 1: 36%, vs. Homework 4: 89%). It is unclear how much of that recognition came from the positive bias in the wording of the Homework 4 question as opposed to students' learning through the course (the assignments were even weeks apart). Understanding whether this

discrepancy was due to student understanding fomented through the course overall (i.e., students learned to recognize that accessibility benefits everyone) or through the question's positively biased wording (i.e., question wording helped surface students' underlying understanding) could impact course design to better foster this learning. Relatedly, understanding whether the ambiguity of asking students to "correct as many errors as [they] can" helped motivate students to address more errors than they would have had they been given a specific threshold, could also help frame assignment question design. Lastly, while it is encouraging that students appreciated the added value of accessibility as benefitting all users, it is important that students recognize that accessibility primarily impacts how users with disabilities navigate the web and a site's conveniences for abled users must not undermine its access and functionality for disabled users.

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Acknowledgments

We recognize and honor the peoples and ancestors whose bodyminds and labor have been exploited and whose lands have been stolen— both of which we benefit from as settlers on this land and as academics with institutional affiliations. We extend immense gratitude to all the people who supported the writing of this paper through their emotional support and feedback— in particular the first author's #acWriMo accountabili-buddies as well as Vishesh Kumar, Marcelo Worsley, Bruce Sherin, Reed Stevens, and the LS 404/405 course. We also extend our deepest gratitude to all the students in the Intro to Web Development course.