Using Modules to Teach Accessibility in a User-Centered Design Course

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ABSTRACT
Courses in user-centered design, where students learn about centering design on the needs of individuals, is one natural point in which accessibility content can be injected into the curriculum. We describe the approach we have taken with sections in the undergraduate User-Centered Design Course at the University of Maryland, College Park. We initially introduced disability and accessibility in four modules: 1) websites and design portfolios, 2) introduction to understanding user needs, 3) prototyping, and 4) UX evaluation. We present a description of this content that was taught as an extended version in one Fall 2018 section and as an abbreviated version in all sections in Spring 2019. Survey results indicate that students' understanding of accessibility and assistive technology increased with the introduction of these modules.

Author Keywords
Curricula; Course design; User Centered Design

ACM Classification Keywords
CCS → Social and professional topics → Professional topics → **Computing education**.

INTRODUCTION
As a growing number of countries require accessible web sites and application software [3], there is an increasing awareness of the importance of including accessibility concepts in formal education at both the graduate and undergraduate level. Yet, accessibility has historically been left out of curriculum [2] and is not currently a standard part of ACM model curricula. There is a need to introduce accessibility concepts into all technology curricula. Given that goal, many questions exist as to how to best to deliver course content and at what points in the curriculum (e.g., when to first introduce accessibility content into a curriculum and whether to include accessibility concepts in every course [8]). This poster describes the approach used at the University of Maryland, College Park, on the first introduction of accessibility content into the required undergraduate curriculum.

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APPROACH
The College of Information Studies at the University of Maryland has historically been a graduate college. The new undergraduate program in Information Science was first offered in Fall 2016 and has grown rapidly to 900 students in 2019. Undergraduate students in the Information Science major learn technical skills such as database design, information architecture, web and mobile development, and data analytics. Technical knowledge is integrated with perspectives from the social sciences, leadership, and design. Coursework prepares students for roles in information management, information technology, user-centered design, data analytics, and more. Students may go on to become designers, engineers, researchers, and other practitioners that shape the development of technology and information systems. Therefore, it is essential that these students are prepared to contribute to the design of accessible experiences.

We decided to integrate accessibility into the undergraduate User-Centered Design course, as this course focuses on integrating the needs and abilities of individuals in the design of experiences. With a focus on needs and abilities of individuals, we saw this course as a natural starting point to integrate an understanding of disability and accessibility. Our approach to integrating accessibility into this course was through creating modules connected to key topics in user-centered design that were already being taught, but without any emphasis on accessibility. This approach was taken so that it would be seamless for future instructors of the course to integrate the modules into their classes.

The topics, described further below, are: 1) web design, 2) understanding user needs, 3) prototyping, and 4) evaluation. Topic 1 was chosen as an entry point to discuss accessibility, and topics 2-4 represent standard topics taught in user-centered design. In addition to lecture content, to promote "authentic learning" [5] students were assessed on their understanding of the material through in-class activities, homework, and exam questions.

Module 1: Accessible Web Design
Students in some sections of the course create websites that they update throughout the semester with project-related progress. In the lecture, we discussed the importance of accessible website design and introduced the Web Content Accessibility Guidelines (WCAG), which include both general guidance and specific coding examples, for making web content more accessible. The in-class assignment involves visiting a website the student uses frequently and evaluating the site against selected guidelines. In each subsequent project assignment, students reported two new ways that they made their project website more accessible.

Module 2: Contextual Inquiry, Disability, & Assumptions
The first phase of each group project in the class involved interviewing and observing representative users. In the lecture, we emphasized that many people have mistaken assumptions of the needs and abilities of people with disabilities, including in interacting with potential participants. A case study of a "failed" design was presented, where designers assumed forgetting is the main issue for a medication dispenser, rather than the actual issue of people avoiding medications that make them feel uncomfortable or having an identity of being sick. Fitting well into discussion of the double diamond model of design, where the right problem has to be found before the right solution can be determined [4], this case study led to a discussion of cultural and identity aspects of disability.

Module 3: Personas and Implicit Bias
Students learned about the utility of personas as well as potential issues that emerge in their creation, such as implicit bias (where stereotypes creep in to attributions of characteristics of groups, unintentionally). A number of resources were shared to provide examples of how diverse disabilities and accessibility considerations can be incorporated into personas (e.g., [1, 6]). For the project assignment, students were required to include accessibility considerations in personas, with the goal of impacting the accessibility of their end-of-semester designs.

Module 4: Accessibility Evaluations
Students learned about different approaches to evaluating accessibility. An in-class assignment had students complete an assignment that simulates disabilities such as ADHD. We then probed the utility of disability simulations with a reading of how a traditional approach to simulation can instill or intensify fear of disabilities [7]. As a homework assignment, students chose a website, as well as a tool to evaluate its accessibility using W3C tools [9].

MODIFIED VERSION FOR ROLL OUT TO ALL SECTIONS

The modules were pilot tested in Fall 2018 in one section. Modifications were then made to create a version that could be taught by one instructor through guest lectures. This version was rolled out to all sections of the course in Spring 2019. Content was merged from four modules to three and some assignments were removed. Additionally, content was added to the modules about WCAG and other accessibility guidelines for non-web content (e.g., EPUB3 and PDF U/A accessibility). Timely topics were also added, such as algorithmic bias and organizational inclusion of people with disabilities in design.

STUDENT RESPONSE

To assess the impact of the modules, we administered a survey at the beginning and end of each course in which accessibility content was taught. The survey was developed by Teach Access and administered as a part of the Teach Access grant that funded the development of the initial iteration of these modules. The survey included 5-item Likert scale questions (with increasing scores indicating more knowledge/interest) on: a) *current knowledge* of accessibility, assistive technology and accessibility features, guidelines (e.g., WCAG), and regulations (e.g., Americans with Disabilities Act), and b) *interest* in learning about developing technology for people with disabilities or pursuing a career in developing accessible technologies.

We conducted an independent t-test as we did not have IDs to map responses to individual students. Of the 50 students enrolled in the Fall 2018 section, 49 filled out the pre-survey and 48 filled out the post-survey. A Wilcoxon rank sum test indicates that the averaged scores of each student's responses for the post-survey (*Median* = 4.17, IQR= 0.67) were significantly higher than the pre-survey scores (*Median*= 3.50, IQR= 0.54); $W=1904.5$, $p<0.001$. Upon analyzing each Likert scale response, we found that, for questions that assessed current understanding/knowledge of accessibility, there was a significant change between pre and post scores. Course materials appear to have had an effect on student perceptions and understanding of accessibility, which was also reflected in the open-ended survey responses. Many students described an interest in following guidelines (e.g., *"Ill [sic] try to apply web accessibility guidelines to any future web apps I make"),* and some were also motivated to educate others. There was no significant change for questions related to interest in learning about developing technology for or pursuing a career in accessibility.

In the four additional sections where material was taught in a single class (Spring 2019), the averaged scores of each student's post-survey responses (*Median*= 4.08 , *IQR*= 0.99) were also significantly greater than pre-survey responses (*Median*= 3.42, *IQR*= 0.85); $W=8721$, $p<0.001$. As 145 students took the pre-test but only 85 took the post-survey, it is possible that students more interested in accessibility are represented in the post-survey. Further work is needed to assess perceptions and analyze changes in student understanding at a larger scale.

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