A multi-method evaluation of university website accessibility: Foregrounding user-centred design, mining source code and using a quantitative metric

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ABSTRACT

Accessibility, which includes usability evaluation, is an important equity step in assessing the effectiveness and usefulness of online learning for students with sensory disabilities. A model for accessibility evaluation has been developed on the basis of a multi-method approach as well as with reference to the characteristics of groups with disabilities and the features of university web-based systems.

CCS Concepts

Human-centered computing → **Accessibility** → **Accessibility design and evaluation methods**

Information systems → **World Wide Web** → **Web mining**

Keywords

accessibility evaluation, user-centred design, assistive technologies, subjective evaluation, objective evaluation, WEB mining, university website, quantitative metric

1. INTRODUCTION

The main goals of accessibility evaluation are to determine and report accessibility problems for resolution to improve the online experience of users with disabilities. Thus, standards are used such as Section 508.2 and WCAG 2.0 and automated evaluation tools (AETs) such as Achecker guide WAVE that facilitate the measurement of accessibility and the identification and resolution of errors that violate accessibility standards. Despite the sophistication of these tools, however, they present limitations that affect the evaluation of university websites. For example, less attention is devoted to voice recognition functionality than screen reading features. Also, most AETs do not flag inaccessible PDF, Word and PowerPoint links as webpage errors. Moreover, they are deficient solution from which to examine the needs of people on the basis of their characteristics, including combined disabilities. Finally, standards and AETs are also designed as a universal method that applies to all web-based systems, yet the reality is that accessibility priorities should vary from one web-based system to another. In an educational system, for instance, the priority of developers is the accessibility of PowerPoint files, whereas in a commercial system, this component is of low priority. Also, the priority differs according to the type of

disability whether cognitive or another type such as sensory disability.

2. RESEARCH MODEL

Accessibility is a complicated matter that involves the consideration of many aspects, including the features of web-based systems, the characteristics of groups with disabilities, the effects of embedded files, and the roles of assistive technologies. The proposed model (see Figure 1) considers subjective and objective measurements. The subjective evaluation conforms to user-centred design (UCD) theory and, on the basis of usability and accessibility statements, is derived from state-of-the-art standards. The specific foundation materials are WCAG, SUMI, IBM Usability Evaluation, Section 508 and PDF and MS Office standards. The objective evaluation has been developed using automated tools, human and a quantitative metric (A3 formula). Source code mining is also carried out in developing the evaluation. Research outcomes are expected to influence the types of information incorporated into the evaluated systems and the development plans.

Figure 1. Diagram of proposed evaluation model.

2.1 Subjective Evaluation

The evaluation process indicated in the proposed subjective evaluation method is divided into five phases (see Figure 2).

Figure 2. Proposed subjective evaluation model.

2.2 Objective Evaluation

Objective accessibility measurements will be initiated with automated tools that generate accessibility reports on all accessibility errors found in university webpages. Source code mining will then be conducted to evaluate media content accessibility errors. Subsequently, human evaluation will be performed to validate the findings of the other evaluation methods and assess assistive technology software, specifically a screen reader and a voice recognition program. The next step is document file evaluation performed with automated tools and human evaluation, as well as with reference to WCAG 2.0. After the objective evaluation is complete, a quantitative metric-based assessment will be implemented. The quantitative metric adopted in this work is grounded in the priority features of university systems and the characteristics of deaf, visually impaired, and deaf-blindness students (see Figure 3).

Figure 3. Proposed objective evaluation model.

3. STUDY CONTRIBUTIONS

This study contributes to theory and practice in two ways. First, it is expected to enhance theoretical approaches to evaluating accessibility and to using data quality as a basis in experimentally determining the accessibility of university websites, as well as of ancillary tools and resources. Second, the research is aimed at promoting the regulation of accessibility and advancing understanding of the academic lives of targeted students.

3.1 Theoretical Contributions

This study presents the following theoretical contributions:

1. Development of a multi-method approach to accessibility evaluation, with the design grounded in the characteristics of populations with disabilities as well as the roles played by media and document files in accessibility.

2. Use of UCD as a subjective measurement of accessibility with respect to usability.
3. Reformulation of an accessibility evaluation metric so that evaluation includes an analysis of the accessibility of document and media files.
4. Elucidation of how accessibility knowledge can be mined and compared through the examination of linked data that are collected from subjective and objective evaluations.
5. Delineation of how the outcomes of accessibility evaluation can be used as a basis in designing a set of accessibility guidelines for educational systems, and creating a foundation for developing an adaptive and accessible quality content framework for such systems.

3.2 Practical Contributions

The specific practical contributions are as follows:

1. The study evaluation of priority accessibility errors for deaf, visually impaired, and Deaf-blindness students, the evaluation is conducted using a survey.
2. Mapping of the relationship between usability and accessibility statements to create accessible and usable questionnaire statements.
3. Identification of the correlation between variations in accessibility between the learning materials (documents and media files) and webpage content found in university websites, the complexity of the content in such systems is referred to in the identification. The experimental design also considers large-scale components for ensuring improved accessibility.
4. Adoption of source code mining as an evaluation method that can advance the detection of behaviours related to accessibility attributes for media content, such as image, video and audio files.
5. The accuracy of accessibility evaluation is maintained by adhering closely to sampling criteria.

3.3 Academic Lives of Deaf, Visually impaired, and Deaf-blindness Students

Other contribution that favourably influence the university lives of students with disabilities in this regard are as follows:

1. The proposed solutions reduce the amount of effort and time that students spend in interacting with university websites.
2. The proposed solutions increase student independence in interacting with university systems.
3. The proposed solutions enhance student satisfaction with their experience in interacting with university websites.

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