Development of Counseling Sites with Digital Accessibility Features for the Blind and Visually Impaired Students

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Abstract. Current counseling services, such as those available through sikons.upgris.ac.id, lack full accessibility for students with disabilities, particularly those who are blind and visually impaired. Studies reveal significant accessibility barriers across educational websites, impeding equal access for users with disabilities. This study addresses these gaps by developing an accessible counseling platform aligned with Web Content Accessibility Guidelines (WCAG) to ensure inclusive access for all students. Using the ADDIE model's structured stages of Analysis, Design, Development, Implementation, and Evaluation, this study aims to create a technically advanced, user-centered application that enhances usability and independence for students with disabilities. Results from user acceptance testing with 11 participants indicated a high satisfaction rate of 89,33%, demonstrating that the platform effectively meets users' needs, significantly improving accessibility and usability in educational counseling services. This outcome underscores the importance of integrating accessibility standards to foster inclusivity and equitable participation in digital educational resources.

1.   Introduction

Disability-friendly counseling services are essential for students with disabilities to effectively meet their mental health needs [1], [2], [3], [4]. This service provides a platform for students with disabilities to communicate their challenges in a safe and supportive environment, improving their overall well-being and academic success. A counseling model adapted for students with disabilities, offering a choice between peer and professional counselors, contributes to an inclusive educational environment and smart governance principles.

Additionally, counselor competency in working with clients with disabilities is critical, highlighting the need for training and clinical experience in this area. By understanding the nature of disabilities and providing active assistance to students with disabilities, counseling services can

significantly impact cognitive, emotional, and social aspects, as well as promote holistic development and equal access to academic services.

Currently, a website-based counseling service has been developed via *sikons.upgris.ac.id*, but this service is not yet disability friendly. Web accessibility is critical to ensuring equal access to online information, especially for students with disabilities. Studies highlight significant issues with web accessibility on popular e-commerce platforms in India, emphasizing the importance of adhering to Web Content Accessibility Guidelines (WCAG) standards to promote economic independence [5]. Additionally, it is important for governments and organizations to prioritize the accessibility of online content to involve a wider range of users in the decision-making process, regardless of their health conditions [6]. To address these issues, incorporating accessibility at every stage of application development, learning WCAG best practices, and implementing inclusive design and extensive accessibility testing are important steps to ensure that online services are accessible to all users, including individuals with disabilities.

The formulation of the problem is that there are no digital features on the counseling website that can be accessed by people with disabilities. So the aim of this research is to create a counseling website that can be operated by people with disabilities by implementing the WCAG 2 standard, namely Web Accessibility Initiative - Accessible Rich Internet Applications (WAI-ARIA) , so that the website can be read using a screen reader properly. By designing and developing a counseling website can be read using a screen reader properly, the aim is to increase the accessibility of online counseling services for students with disabilities. With this approach, we hope to provide an inclusive and equitable counseling experience for all students.

2.   Methods

The research method used in this research is the research and development (R and D) method. The product developed in this research is a Counseling Websites with access feature for visually impaired students. This research and development method allows us to analyze products to obtain data about student needs, whether the product functions well, and its usefulness for students with disabilities. The development model used in this research is the ADDIE development model [7]. ADDIE's structured approach helps define a solid foundation of accessibility standards, and adapted a small part of a prototyping model [8] to provides flexibility to refine specific features continuously.

The ADDIE development model is suitable for mobile-based media and software development, uses systematic development stages, and is easy to understand. The ADDIE development model consists of five stages: 1) analysis, 2) design, 3) development, 4) implementation, and 5) evaluation. The ADDIE model development process is shown in Figure 1. ADDIE model research stage.
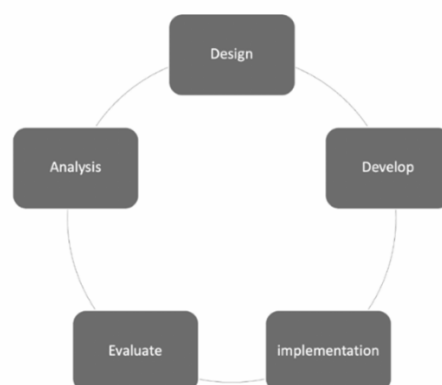

Figure 1 ADDIE Model

2.1. Analysis

The first stage in the ADDIE development model is analysis. Researchers conducted a needs assessment through interactions with potential users to understand their needs and preferences regarding the use of screen reader applications for counseling websites.

2.2. Design

The second stage of the ADDIE model is design. Design carried out when implement the screen reader application for the counseling website for students with disabilities. Design user interfaces that are intuitive and accessibility-friendly, ensuring that users with disabilities can use the application easily.

2.3. Development

The third stage of the ADDIE development model is development. At the development stage, implement a screen reader application using modern web technologies such as HTML, CSS, and JavaScript and WAI ARIA semantic rules with a focus on cross-platform compatibility and support for various screen readers, then verify it by material experts and media experts based on the product design carried out at the design stage. This validation process was carried out to determine the level of suitability of the media and to obtain advice and opinions from experts to improve the quality of the product before testing it on students with disabilities.

2.4. Implementation.

The fourth stage of the ADDIE development model is to test the application with users representing of disabilities, and update the application based on the feedback received. Implement a screen reader application on the counseling website, and officially launch it after ensuring its optimal performance.

2.5. Evaluation

The evaluation stage carries out an evaluation stage of the counseling website. After carrying out the evaluation stage, data was collected and analyzed using qualitative and quantitative data, so that the data can be used to determine whether or not the implementation of screen reader application on the counseling website is effective in improving the mental health of students with disabilities.

3. Results and Discussion

The ADDIE model, a systematic framework for instructional and development processes, is utilized to guide the development of an accessible counseling site for blind and visually impaired students.

3.1. Analysis

Conduct an assessment to identify the specific needs of blind and visually impaired users. This involves consulting accessibility standards like the Web Content Accessibility Guidelines (WCAG) and conducting interviews or surveys with visually impaired individuals to understand their challenges in accessing online content.

For the User Needs Assessment based on the Focus Group Discussion (FGD) The FGD involved a total of seven participants, carefully selected to represent diverse perspectives, expertise, and experiences relevant to the development of an accessible digital platform. Participant Demographics and Rationale for Selection:

1. Blind Government Employee
   - Profession: A blind government employee with a bachelor's degree, working in a role that requires frequent use of digital platforms.
   - Device Proficiency: Proficient in using both laptops and mobile devices, extensively relying on screen readers (e.g., NVDA, TalkBack) and shortcut keys for navigation.
   - Rationale: Selected to represent the target user group, offering insights into accessibility needs and challenges faced by visually impaired individuals in professional environments.

2. Three Researchers
   - Background: Researchers with expertise in psychology, accessibility standards, user-centered design, and digital inclusion.
   - Role: Their input was critical in interpreting accessibility challenges and aligning the website's features with global standards like WCAG and WAI.
   - Rationale: Selected for their academic and practical experience in studying the needs of visually impaired users and designing solutions to address them.
3. Two Research Assistants
   - Background: Research assistants actively involved in the development of the website, including the design, testing, and evaluation phases.
   - Role: They contributed technical insights into the implementation of accessibility features and usability testing processes.
   - Rationale: Included to ensure a seamless integration of user feedback into the development pipeline and to provide technical validation of proposed features.
4. One Professional Web Developer
   - Background: A professional web developer specializing in creating accessible digital platforms.
   - Role: Provided practical recommendations on implementing ARIA attributes, screen reader compatibility, and text-to-speech functionalities.
   - Rationale: Chosen for their technical expertise in web development and their experience in applying accessibility standards to real-world projects.

Recommendations for Website Development Based on FGD Insights :
- Design with a simple, well-structured layout, optimized for screen reader compatibility.
- Ensure all interactive elements (buttons, forms, links) are labeled for screen reader accessibility.
- Implement robust keyboard-only navigation with shortcuts to key areas for efficient interaction.
- Offer adjustable contrast and font size options to enhance accessibility for users with varying degrees of visual impairment.

3.2. Design

In Design phase we studied these articles [9], [10], [11], [12], [13], [14] to integrating WCAG (Web Content Accessibility Guidelines), WAI (Web Accessibility Initiative), and ARIA (Accessible Rich Internet Applications) [15], [16] principles to ensure the site is accessible and user-friendly for blind and visually impaired users.

1. WCAG (Web Content Accessibility Guidelines) Compliance :
- Perceivable Content: Ensure all content, including text, images, and interactive elements, is perceivable to users through assistive technologies.
- Text Alternatives: Provide descriptive alt-text for all images to ensure screen readers can convey image content. For non-text content, such as icons, include accessible text labels.
- Time-Based Media: Offer transcripts or text descriptions for any multimedia elements (e.g., videos or audio).
- Adjustable Text and Contrast: Implement high-contrast options and allow users to adjust text size, meeting WCAG requirements for contrast ratios.
- Operable Navigation: Design navigation that is accessible by both mouse and keyboard.
- Keyboard Navigation: Ensure that all interactive elements are keyboard-accessible, with logical tab ordering.
- Semantic HTML: Use HTML5 tags properly for headings, lists, buttons, and forms to provide logical structure. Semantic HTML improves compatibility with screen readers
- Responsive Time Limits: Avoid timed elements wherever possible, include options to extend time limits.
- Understandable Interface: Make the user interface intuitive and predictable.
- Consistent Navigation and Labels: Use consistent labels, headers, and structure across pages to

help users navigate easily.

- Robust Content Compatibility: Ensure content is compatible with a range of assistive technologies.
- Error Identification: Provide clear error messages with suggestions for correction, especially for form inputs. Ensure errors are announced by screen readers to make correction accessible.

2. WAI (Web Accessibility Initiative) Best Practices :

- User-Centered Design: Following WAI principles, involve blind and visually impaired users in usability testing throughout the design phase to gather feedback on navigation, accessibility features, and content structure.
- Accessible Forms: Label all form fields clearly and ensure each field is accessible via keyboard and compatible with screen readers. Use simple, descriptive labels that screen readers can interpret correctly.

3. ARIA (Accessible Rich Internet Applications) Attributes

- Interactive Element Labels: Use ARIA labels and roles to make interactive elements, like buttons and drop-down menus, screen-reader-friendly.
- ARIA Roles and States: Assign roles (e.g., *button, navigation, form*) to interactive elements, and use ARIA states (e.g., *aria-expanded, aria-pressed*) to communicate element statuses to screen readers.
- ARIA Live Regions: Use aria-live attributes for dynamic content (such as notifications or alerts) to inform screen readers of changes without requiring user interaction.
- Form and Error Handling: Implement ARIA attributes for error messages to make them accessible. For instance, use aria-describedby to connect input fields with relevant error messages, ensuring users are notified of errors immediately.

3.3. Development

In Development phase :

- Mapping Interactive Elements : Identify key website elements that users will access with a screen reader (Windows Narrator). Focus on mapping components that require interaction or are essential for user navigation and engagement.
- Labeling and Enhancing Accessibility : Provide labels or additional information for each element to ensure clear screen reader compatibility. This labeling ensures that screen readers can convey the purpose and function of each element accurately.
- Filtering Essential and Non-Essential Elements : Determine which elements are essential versus less critical to streamline the screen reader experience, emphasizing the delivery of key information for users with disabilities.
- Internal Testing of Windows Narrator Accessibility: Conduct internal testing to verify the functionality of the Windows Narrator and ARIA integration on each website page. Ensure accessibility and usability standards are met.
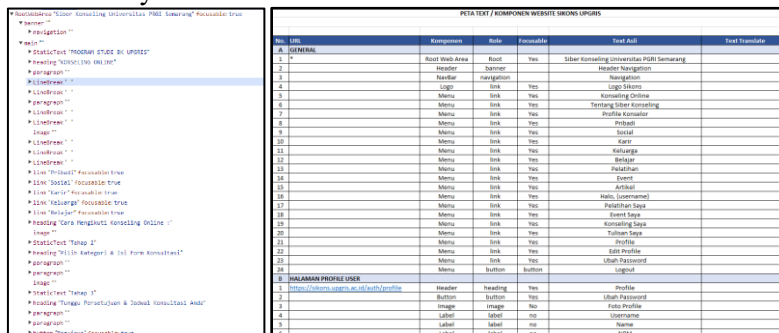

Figure 2 Mapping Interactive Elements

Table 1. Tasks and Results in Development stage

No	Task	Notes	Result
1	Map key website elements for user interaction	Focus on essential interactive elements only.	WEB MODULE GENERAL: 15 pages done
2	Refine labels and text for screen reader clarity	Ensure descriptions are accurate and informative.	COUNSELING APP MODULE: 19 pages done
3	Filter important vs. non-essential elements	Emphasize user-centered information presentation.	WEB MODULE GENERAL: 15 pages done
4	Implement ARIA attributes for selected elements	Apply WAI-ARIA to identified key elements.	COUNSELING APP MODULE: 19 pages done

3.4.   Implementation

Perform direct usability testing with visually impaired users to evaluate their interaction with the website and gather feedback on accessibility.

Table 2.Tasks and Results in Implementation stage

No	Task	Notes	Result
1	Test element interaction using Windows Narrator	Verify accessibility and navigation ease.	Several key insight
2	Direct usability testing with blind and visually impaired users	Collect user feedback and identify issues	Meetings with Sahabat Mata
3	Review and refine based on user feedback	Make necessary adjustments to improve usability.	Done adjustments

In the implementation phase, we conducted three meetings with the Sahabat Mata community, involving a total of 11 personas, including participants from the initial focus group discussion (FGD). The feedback gathered from these sessions highlighted several key insights:

· Dedicated Voice Options: Participants suggested the inclusion of a dedicated menu for built-in voice options or voice applications. This would prevent any conflicts with screen reader functionalities, ensuring that users can navigate the site smoothly without overlapping audio outputs.

· Distinct Vocaliser Differentiation: It was recommended that the vocaliser be differentiated between main menus and submenus. This distinction is crucial for users to understand their navigation context better, allowing for a more intuitive and accessible experience.

· Website Design Concerns: The current website design, which utilizes slides, was identified as a barrier to accessibility for visually impaired users. Participants expressed the need to transition to a more straightforward paragraph format, which would enhance readability and navigation for those with visual impairments.

Notably make necessary adjustments to improve usability:

· Simplified Login: We designed a user-friendly login process tailored to the needs of visually impaired users, ensuring that they can access the platform with minimal barriers.
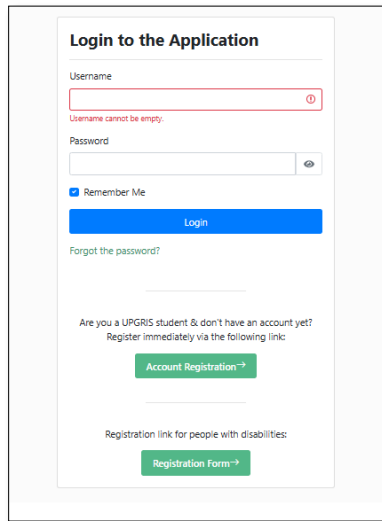
Figure 3 Simplified Login

· Text-to-Speech Functionality for Consultation Forms: After users complete the consultation form, we integrated a text-to-speech feature that reads back the input text. This allows users to verify their entries before submission, enhancing confidence in their consultation details.


Figure 4. Text-to-Speech Functionality for Consultation Forms

3.5. Evaluation

In this phase, we conducted a comprehensive User Acceptance Test (UAT) to ensure that the developed counseling website met the needs of the visually impaired users. The evaluation involved the following User Acceptance Testing (UAT) that engaged a diverse group of 11 participants from the Sahabat Mata community, including one participant who had previously participated in the Focus Group Discussion (FGD).

This allowed to gather extensive feedback regarding the website's accessibility features and overall usability. The result is 67 points from total 75 points = 89,33%, The average score of 89.33% indicates a high level of user satisfaction and effectiveness in meeting the accessibility needs of blind and visually impaired users. This score reflects that the majority of participants found the website intuitive, easy to navigate, and equipped with necessary accessibility features.
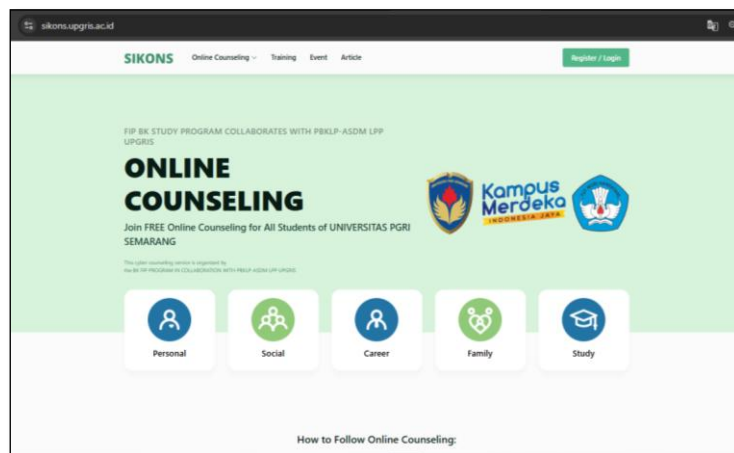
Figure 5. Sikons Website

The accessibility review of the website as studied in article[17], [18], [19], [20], [21], [22], [23], [24], [25], adhering to WCAG 2.0 Level AA standards.

This website accessibility review result from A Checker are : Known Problems (34), Likely Problems (0), indicates several positive aspects and areas of concern. Notably, the absence of likely problems suggests the site does not have potential accessibility issues that could hinder users. Furthermore, compliance with these established standards reflects a commitment to creating an inclusive experience for users with disabilities. The presence of 34 known problems is a significant concern, as these confirmed issues can create barriers for individuals relying on assistive technologies. This indicates a need for immediate attention to address fundamental accessibility challenges and improve overall user experience. The review adheres to WCAG 2.0 Level AA standards, which is the recommended level for ensuring accessibility. Achieving this level indicates a commitment to providing a more inclusive experience for users with disabilities.

The next step in this evaluation is to assess the effectiveness of implementation the screen reader application on the counseling website in improving the mental health of students with disabilities. This assessment will involve collecting and analyzing relevant data, including user experiences and outcomes associated with the use of the application. However, the analysis and findings of this evaluation will not be discussed here, as they will be presented in a separate article. That article will provide in-depth insights into the impact of the implementation screen reader application on students' mental health, along with recommendations for further development.

4.   Conclusion

The development of the counseling website (sikons.upgris.ac.id) with digital accessibility features for the blind and visually impaired has yielded significant insights and results. This project aimed to create a user-friendly platform that meets the unique needs of visually impaired users, ensuring they can access counseling services effectively.

Analysis process guided by the ADDIE model, researchers conducted a comprehensive User Needs Assessment, which included a Focus Group Discussion (FGD) with a blind and visually impaired participant. This initial engagement provided critical insights into their online habits and preferences, allowing us to tailor the website features accordingly.

The design phase incorporated widely recognized accessibility standards, including the Web Content Accessibility Guidelines (WCAG) and the Web Accessibility Initiative (WAI) best practices. By implementing Accessible Rich Internet Applications (ARIA) attributes, we ensured that interactive elements were properly labeled and communicated effectively to screen readers thus enhancing the overall user experience.

In the development phase, we meticulously mapped the interactive elements of the website, focusing on accessibility through features such as screen reader (Windows Narrator), compatibility and text-to-speech functionalities. This approach not only streamlined the user experience but also ensured that essential information was readily available to users with visual impairments.

The User Acceptance Test (UAT), conducted with 11 participants from the Sahabat Mata community, yielded a commendable score of 89.33%, reflecting a high level of satisfaction with the website's accessibility and usability. The positive feedback from users confirmed that the site successfully addressed their needs, providing an intuitive and accessible platform for counseling services. However, the UAT also highlighted areas for improvement.

Users suggested additional features, such as dedicated voice options and clearer auditory cues for navigation. These insights will be invaluable for future iterations of the website, guiding ongoing enhancements to ensure it continues to serve the needs of its users effectively.

In conclusion, this project not only demonstrates the feasibility of creating a counseling website tailored for the blind and visually impaired but also underscores the importance of user-centered design in developing accessible digital solutions. The findings affirm that with the right methodologies and standards in place, it is possible to build inclusive platforms that empower visually impaired individuals to access essential services independently. Moving forward, this work will serve as a foundation for further research and development in the field of digital accessibility, contributing to the ongoing dialogue about inclusivity in technology.

Acknowledgements

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