



Study of accessibility needs of people with visual impairments and how they align with WCAG 2.0 guidelines

A Study of WCAG 2.0 Guidelines

Benaris Hajduk

Ismail Ali

This thesis is submitted to the Faculty of Computing at Blekinge Institute of Technology in partial fulfilment of the requirements for the degree of Bachelor of Science in Software Engineering. The thesis is equivalent to 10 weeks of full time studies.

The authors declare that they are the sole authors of this thesis and that they have not used any sources other than those listed in the bibliography and identified as studys. They further declare that they have not submitted this thesis at any other institution to obtain a degree.

Contact Information:

Author(s):

Benaris Hajduk

E-mail: beha20@student.bth.se

Ismail Ali

E-mail: isal20@student.bth.se

University advisor:

Henry Edison

Department of Software Engineering

Faculty of Computing
Blekinge Institute of Technology
SE-371 79 Karlskrona, Sweden

Internet : www.bth.se
Phone : +46 455 38 50 00
Fax : +46 455 38 50 57

Abstract

This study aimed to investigate the needs and challenges faced by visually impaired individuals when using the internet and assess the compatibility of the challenges they face with the Web Content Accessibility Guidelines (WCAG 2.0). By examining these aspects, through analysis of existing literature, surveys and interview. The study sought to gain insights into the difficulties experienced by the visually impaired community and provide recommendations for improving web accessibility and contribute to the development of more accessible and user-friendly web content. This, in turn, can improve the quality of life for individuals with visual impairments and promote their active involvement in social, economic, and cultural activities. The study findings indicate common obstacles faced by individuals with visual impairments when accessing the internet, including difficulties in reading text, limited customization options, insufficient color contrast, poorly structured content, inaccessible forms or inputs, challenges in identifying images or icons, navigating web pages, and completing forms.

Individuals with visual impairments have unique requirements when using the internet, such as the use of assistive technologies and alternative text descriptions. However, they encounter various obstacles that hinder their access and engagement with digital content and services. Although WCAG 2.0 serves as a foundational framework for web accessibility, there is still room for improvement in terms of awareness, implementation, and testing. Further efforts are necessary to enhance internet accessibility for individuals with visual impairments, facilitating their full participation in social, economic, and cultural activities.

Keywords: Web accessibility, Visual impairments, Web Content Accessibility Guidelines 2.0, Accessibility

Acknowledgments

We would like to extend our sincere gratitude to all the people and organizations who participated in this study, without their participation, this study would not have been possible to have been carried out.

We would like to thank KnowIT, SRF Blekinge and Kronoberg for their collaboration and support throughout this research. Their expertise and resources greatly enriched the project and facilitated the gathering of essential data.

We are indebted to our supervisor, Henry Edison, for his unwavering guidance, patience, and encouragement. His expertise in the field and insightful suggestions have been invaluable in refining the research. We are grateful for his continuous support and dedication.

Last but not least, We want to extend our heartfelt gratitude to our families for their unwavering support, understanding, and patience throughout the research process. Their love and encouragement provided us with the strength and motivation to overcome challenges and pursue this endeavour.

Once again, We extend our sincere thanks to all those who have contributed to this research. Their assistance and support have been truly invaluable, and we are forever grateful for their involvement in this project.

Contents

Abstract	i
Acknowledgments	iii
1 Introduction	3
1.1 Background	3
1.2 Objectives	3
1.3 Contribution	4
2 Related Work	5
2.1 Introduction	5
2.2 Wcag-easy tool: A tool based in the wcag to learn web accessibility .	5
2.3 Factors associated with online learning self-efficacy among students with disabilities in higher education	5
2.4 Evaluating progressive web app accessibility for people with disabilities	6
2.5 Accessibility evaluation using web content accessibility guidelines (wcag) 2.0	6
2.6 Vis-a-wis: Improving visual website through automatic web content adaptation	6
2.7 Wcag 2.0: The future of web accessibility	7
2.8 A study of wcag 2.0 guidelines for improving web accessibility for people with disabilities	7
2.9 Web content Accessibility Guidelines (WCAG 2.0)	7
3 Method	9
3.1 Introduction	9
3.2 Research Questions	9
3.3 Approach	10
3.3.1 Search String	10
3.4 Interviews	11
3.5 Surveys	11
4 Results and Analysis	13
4.1 Introduction	13
4.2 Results	13
4.2.1 Common obstacles and challenges	15
4.2.2 Suggested Improvements for Enhanced Accessibility	15
4.3 Analysis	17

<i>Acknowledgments</i>	1
4.3.1 Themes and patterns	17
4.4 Themes analysis	18
4.4.1 Demographics (33 participants)	20
4.4.2 Visual impairment	20
4.4.3 Awareness of WCAG 2.0	21
4.4.4 Usage of WCAG 2.0 Guidelines	22
4.4.5 Internet Access encountered difficulties	22
4.4.6 WCAG 2.0 Accessibility needs	22
5 Discussion	25
5.1 Discussion	25
6 Conclusions and Future Work	27
References	29
A Supplemental Information	31
B Survey	35
C Interview Transcript	43
D Consent form template	47

1.1 Background

Web accessibility is now more important than ever to guarantee that everyone has equitable access to the opportunities offered by the internet as digital technology becomes more widely used. People with visual impairments are among the people that encounter considerable difficulties in accessing web content. To view web pages, they frequently need assistive technologies like screen readers. To do this, though, web developers have to develop a more easily accessible and readable material that meets the particular requirements of this audience.

The internet has revolutionized the way we interact, access information, and perform daily tasks. However, for people with disabilities, accessing web content can be challenging and frustrating. Individuals with visual impairments are particularly affected, as many websites lack the necessary accessibility features to accommodate their needs. According to a report by the Swedish National Agency for Special Needs Education and Schools, in 2018, there were approximately 500,000 people in Sweden who had some form of disability, of which approximately 60,000 were visually impaired. This number includes both people with mild and severe visual impairments. Thus, addressing the accessibility needs of individuals with visual impairments is critical for promoting their full participation in society.

The World Wide Web Consortium (W3C) introduced the Web Content Accessibility Guidelines 2.0 (WCAG 2.0) [3] using Web Accessibility Initiative (WAI), working alongside individuals and organizations worldwide. Their objective was to establish a unified standard for web content accessibility that fulfills the requirements of individuals, organizations, and governments on a global scale.

1.2 Objectives

The objectives of this study were to examine the requirements for people who were visually impaired when using the internet, to identify the challenges they faced when accessing online content, and to assess how well their needs and challenges align with the Web Content Accessibility Guidelines (WCAG 2.0). This study aimed to learn more about the difficulties faced by those who were blind or visually impaired and to offer suggestions for enhancing this user group's web accessibility. By attaining these goals, the study aimed to help make the digital world more accessible for those with visual impairments. The research questions are as follows:

- What are the specific needs of people with visual impairments when using the internet?
- What obstacles do people with visual impairments face when accessing the internet?
- How well do the accessibility requirements of individuals with visual impairments align with the guidelines specified in WCAG 2.0?

1.3 Contribution

The internet has revolutionized the way we interact, access information, and perform daily tasks. However, for people with disabilities, accessing web content can be challenging and frustrating. Individuals with visual impairments are particularly affected, as many websites lack the necessary accessibility features to accommodate their needs. This creates a significant barrier for individuals with visual impairments, preventing them from fully participating in the digital age and accessing the vast array of resources available online. As a result, it is crucial to address this issue and make the internet more inclusive and accessible for everyone. Improving web accessibility not only benefits individuals with disabilities but also contributes to a more inclusive society overall. By making the internet more accessible, we can create equal opportunities for all individuals to participate in education, employment, social interactions, and various online services.

2.1 Introduction

This chapter presents an overview of relevant research and studies in the area of web accessibility, focusing on the needs and challenges of those with visual impairments. The chapter aims to explore existing tools, evaluations, and guidelines that contribute to improving web accessibility for people with visual impairments. By examining these works, we gain insights into the current state of research in this field and identify potential areas for further investigation.

2.2 Wcag-easy tool: A tool based in the wcag to learn web accessibility

The WCAG-easy tool [4], which is based on the Web Content Accessibility Guidelines (WCAG), is presented by Germano and Silveira. The program is intended to make it easier to learn about web accessibility. It sheds light on potential barriers to internet access for those with visual impairments by emphasizing how simple it is to comprehend and apply the WCAG criteria. The study's goal is to create and assess the WCAG-easy tool. The WCAG-easy tool increases learning and comprehension of web accessibility requirements.

2.3 Factors associated with online learning self-efficacy among students with disabilities in higher education

Lee, Kim, and Gezer [6] conducted a study to investigate the factors associated with online learning self-efficacy among students with disabilities in higher education. While this study is not directly focused on visual impairments, it provides valuable insights into the obstacles that students with disabilities, including visual impairments, may encounter when accessing online content. The study explores the self-efficacy of students with disabilities, which can shed light on the challenges faced by this group when accessing online educational materials. The objective is to identify factors influencing online learning self-efficacy. The important finding is

that factors such as computer anxiety, internet self-efficacy, and perceived usefulness significantly impact the online learning self-efficacy of students with disabilities.

2.4 Evaluating progressive web app accessibility for people with disabilities

Roumeliotis and Tselikas [8] evaluate the accessibility of Progressive Web Apps (PWAs) for people with disabilities. Although not exclusively focused on visual impairments, the study assesses the overall accessibility of PWAs, which can provide insights into the obstacles faced by individuals with visual impairments when using such applications. The objective of the study is to evaluate the accessibility of PWAs based on WCAG guidelines. The important finding is that PWAs can be made more accessible by following WCAG guidelines and incorporating accessibility features.

2.5 Accessibility evaluation using web content accessibility guidelines (wcag) 2.0

Isa, Suhaimi, Ariffn, Ishak, and Ralim [5] discuss the evaluation of accessibility using WCAG 2.0. The study explores how adherence to WCAG 2.0 guidelines can improve accessibility for individuals with disabilities. While not specific to visual impairments, the research provides insights into the accessibility requirements for people with disabilities when accessing web content. The objective is to evaluate accessibility using WCAG 2.0 guidelines. The important finding is that adherence to WCAG 2.0 guidelines improves the accessibility of web content.

2.6 Vis-a-wis: Improving visual website through automatic web content adaptation

Santucci presents the Vis-A-Wis tool [9], which focuses on improving visual websites through automatic web content adaptation. Although not directly addressing visual impairments, the tool's objective aligns with the first research question by aiming to enhance the web experience for individuals with disabilities. The Vis-A-Wis tool mentioned in Santucci's work aims to automatically adapt web content to improve the visual experience for users, which can indirectly benefit individuals with visual impairments. By optimizing visual elements, such as layout, color contrast, and text size, the tool contributes to addressing the specific needs of people with visual impairments when using the internet. The objective of the tool is to enhance the accessibility and usability of websites. While specific findings are not mentioned in the study, the Vis-A-Wis tool provides a valuable approach to improving the web experience for individuals with visual impairments by automatically adapting visual content.

2.7 Wcag 2.0: The future of web accessibility

Li, Li, and Ni [7] provide an overview of WCAG 2.0 guidelines and their significance for web accessibility. This study is directly related to the third research question, which focuses on evaluating how well the WCAG 2.0 guidelines address the accessibility requirements of people with visual impairments. The objective of the study is to provide an overview of WCAG 2.0 guidelines. While specific findings are not mentioned in the study, the work highlights the importance of WCAG 2.0 guidelines in promoting web accessibility for individuals with visual impairments.

2.8 A study of wcag 2.0 guidelines for improving web accessibility for people with disabilities

Ahmed and Othman [2] conducted a study to evaluate the implementation of WCAG 2.0 guidelines in web design and development practices, with the aim of improving web accessibility for people with disabilities. This study directly addresses the third research question by examining how well WCAG 2.0 guidelines address the accessibility requirements of people with visual impairments. The objective of the study is to assess the implementation of WCAG 2.0 guidelines. The important finding is that while WCAG 2.0 guidelines contribute to improving web accessibility, further efforts are needed to ensure comprehensive accessibility for individuals with disabilities, including those with visual impairments.

2.9 Web content Accessibility Guidelines (WCAG 2.0)

Web Content Accessibility Guidelines (WCAG) 2.0 [3], developed by the World Wide Web Consortium (W3C), aim to ensure web content is accessible to individuals with disabilities. These guidelines consist of four main principles: Perceivable, Operable, Understandable, and Robust. The Perceivable principle focuses on making web content perceptible to all users, including providing alternative text for non-text content, offering alternatives for time-based media, enabling content presentation in different ways, and enhancing visibility and audibility. The Operable principle emphasizes interactive and navigable web content, including making all functionality available from a keyboard, allowing sufficient time for content consumption, avoiding designs that trigger seizures, and providing navigation aids. The Understandable principle aims to make web content clear and comprehensible by using readable and simple language, ensuring predictability and consistency, and helping users avoid and correct mistakes. Lastly, the Robust principle focuses on compatibility with various user agents and future technologies, emphasizing the use of coding practices that support different browsers and assistive technologies.

3.1 Introduction

This chapter presents the methodology used to investigate the specific needs and obstacles faced by individuals with visual impairments when using the internet. The chapter is structured as follows: firstly, the research questions are outlined. Secondly, the approach employed to address these research questions is described, including the data collection methods and analysis techniques. Finally, the chapter discusses the search string used for the literature review, as well as the interviews and surveys conducted to gather insights from individuals with visual impairments.

3.2 Research Questions

1. What are the specific needs of people with visual impairments when using the internet?
 - Understanding their specific needs when using the internet is crucial for developing accessible websites, applications, and technologies that cater to their needs. By identifying their specific needs, we can identify the challenges they encounter and the accommodations necessary to provide an inclusive online experience.
2. What obstacles do people with visual impairments face when accessing the internet?
 - Identifying these specific obstacles is crucial for improving their overall internet experience and developing effective solutions. By identifying these specific obstacles we can work towards creating inclusive digital environments that ensure equal access to information, services, and opportunities for individuals with visual impairments. Additionally, addressing these obstacles can help promote digital inclusion and empower people with visual impairments to fully participate in various online activities, such as education, employment, social networking, and entertainment.
3. How well do the accessibility needs of individuals with visual impairments align with the guidelines specified in WCAG 2.0?

- Evaluating the alignment between accessibility requirements and WCAG 2.0 guidelines enables us to assess the effectiveness of the existing standards. It helps us determine whether the guidelines adequately address the unique challenges faced by individuals with visual impairments or if there is a need for further refinement and updates.

3.3 Approach

In order to address the research questions and gain a comprehensive understanding of the obstacles and challenges faced by individuals with visual impairments, a combination of surveys and interviews was used as the primary data collection methods.

A literature review was conducted initially to establish a foundation of existing research and literature on the topic of web accessibility and the challenges faced by individuals with visual impairments. This approach aligns with the recommendation of Seaman [10] in empirical studies of software engineering, who emphasized the importance of qualitative methods in empirical studies to gain a broader understanding of the research topic and explore the experiences of the participants.

To obtain more specific information on the challenges faced by individuals with visual impairments when using the internet, an online survey was administered to the members of SRF [1]. The survey was designed in accordance of the WCAG 2.0 guidelines.

Furthermore, interviews were conducted with two people who have agreed to signing a consent form prior to the interviews, one representative of SRF and a member of SRF [1] organization. Interviews provide a more in-depth exploration of participants experiences, allowing for a richer understanding of their perspectives and insights. This approach is consistent with Seaman's recommendation to use qualitative methods for empirical studies [10].

Both the survey and interview data consisted of a mix of closed and open-ended questions, to gather both quantitative data and qualitative data for thematic analysis. The collected data were then analyzed using qualitative analysis techniques, such as thematic analysis, to identify emerging themes and patterns. Employing qualitative analysis methods allow to uncover key themes and patterns in the data [10].

Overall, the chosen combination of surveys and interviews, allows for a comprehensive exploration of the most common obstacles and challenges experienced by individuals with visual impairments when accessing the internet.

3.3.1 Search String

To conduct a comprehensive literature review, the following search string was used:

((web accessibility) OR (accessibility)) AND ((visually impaired) OR (visual impairment)) AND ((WCAG 2.0) OR (wcag 2.0))

The search string incorporates keywords and phrases related to web accessibility, visual impairment, and the Web Content Accessibility Guidelines (WCAG) 2.0. To gather a wide range of relevant articles and research papers, two prominent databases were selected, IEEE Xplore and Scopus. The literature search yielded a total of 7 articles that met the inclusion criteria and provided valuable insights into the research

topic. These articles were carefully selected based on their relevance and quality of information.

3.4 Interviews

In order to ensure compliance with research ethics, informed consent was obtained from the participants D. To address the research questions and gain a comprehensive understanding of the obstacles and challenges faced by individuals with visual impairments, semi-structured interviews were conducted with two participants who are referred to as person 1 and person 2 in the transcripts. This interview offered a valuable opportunity to delve deeper into the participants' experiences and perspectives regarding the challenges they encounter when accessing the internet. The interview format allowed for open-ended responses, enabling the participants to provide detailed insights and opinions. For further details on the informed consent, please refer to the consent form template provided in the appendix.

In order to address the research questions and gain a comprehensive understanding of the obstacles and challenges faced by individuals with visual impairments, a semi-structured interviews were conducted with two participants. The participants included one representative from SRF organization and a member of SRF [1].

The interview provided an opportunity to delve deeper into the participants' experiences and perspectives regarding the challenges they face when accessing the internet. The interview were conducted in a manner that allowed for open-ended responses, enabling the participants to provide detailed insights and opinions.

3.5 Surveys

To obtain a broader understanding of the challenges faced by individuals with visual impairments when using the internet, an online survey was administered to the members of SRF [1]. The survey was designed in accordance with the WCAG 2.0 guidelines and included a mix of closed and open-ended questions.

The survey aimed to gather the challenges faced by individuals with visual impairments. The demographic questions included in the survey also contributed to understanding the participants' characteristics and their potential influence on the challenges they face.

Both the interviews and survey responses were analyzed using qualitative analysis techniques, such as thematic analysis. This allowed for the identification of emerging themes and patterns in the participants' experiences and perspectives [10].

Overall, the combination of interviews and surveys provided a comprehensive exploration of the obstacles and challenges experienced by individuals with visual impairments when accessing the internet.

4.1 Introduction

This chapter presents the results and analysis the specific needs and obstacles faced by individuals with visual impairments when using the internet. The chapter begins with an overview of the survey results, highlighting the common obstacles and challenges reported by visually impaired individuals, as well as their accessibility needs. The chapter delves into a detailed analysis of the emerging themes and patterns derived from the data. By employing qualitative analysis techniques, such as thematic analysis, the study identifies and explores key themes related to the obstacles and challenges faced by individuals with visual impairments.

4.2 Results

The survey results provided valuable insights into the perspectives of individuals with visual impairments regarding website accessibility. With a total of 33 participants across diverse age ranges, gender identities, and degrees of visual impairment, the findings shed light on common obstacles and challenges faced by visually impaired individuals when accessing digital content and services online. Notably, the survey data revealed that visually impaired individuals commonly face difficulties such as:

- Challenges in reading text
- Limited customization options
- Inadequate color contrast
- Poorly structured content
- Inaccessible forms or inputs
- Trouble identifying images or icons
- Navigating web pages
- Completing forms

The findings draw attention to a number of crucial topics concerning prospective improvements and impediments to accessibility. In terms of the difficulties faced by people who are visually impaired when using the internet, the survey results showed that common issues included:

- Difficulty reading text
- Lack of customization options
- Lack of colour contrast
- Poorly structured content
- Inaccessible forms or inputs
- Difficulty identifying images or icons
- Difficulty navigating web pages
- Difficulty filling out forms

The results show that another key problem was coming across non-text content without suitable substitutes. The interview results emphasised the need of raising knowledge of visually impaired people's needs and adhering to accessibility standards in terms of enhancements for better accessibility. The recommendations included:

- Making websites mobile-friendly
- Using search engines designed for users who are blind or visually impaired
- Using precise and unambiguous search keywords
- Utilizing main headers and links for navigation
- Using a black background and white font choice for improved reading

With these improvements, those who are blind or visually challenged will be able to browse the internet more effectively and independently. The need for collaboration with web developers and organizations to increase awareness of accessibility challenges was underscored by the main topics of collaboration and awareness.

- Collaborating with web developers
- Instructing visually impaired users on how to utilize accessible technology
- Raising industry awareness

The survey data and interview responses indicate that visually impaired individuals encounter various challenges when using the internet. The findings underscore the importance of:

- Raising awareness
- Complying with accessibility standards
- Optimizing websites for mobile devices
- Providing customization options
- Establishing rules and standards for internet accessibility

These measures, along with collaboration between organisations, can contribute to enhancing internet accessibility for visually impaired individuals and creating a more inclusive digital environment.

4.2.1 Common obstacles and challenges

The findings revealed some common obstacles and challenges faced by visually impaired people:

- **Difficulty reading text:** Visually impaired individuals face challenges in reading text on websites, which can be due to small font sizes, lack of proper formatting, or insufficient contrast between text and background.
- **Insufficient color contrast:** Inadequate color contrast between text and background can make it difficult for visually impaired individuals to discern and read the content.
- **Poorly structured content:** Websites with poorly organized or structured content pose challenges for visually impaired individuals in navigating and comprehending the information effectively.
- **Inaccessible forms or inputs:** Forms and input fields that are not properly labeled or lack proper accessibility features can hinder visually impaired individuals from completing online transactions or submitting information.
- **Difficulty identifying images or icons:** When images or icons lack appropriate alternative text or descriptions, visually impaired individuals may face challenges in understanding the visual content.
- **Difficulty navigating web pages:** Complex navigation structures, lack of clear headings, or excessive distractions on web pages can make it challenging for visually impaired individuals to navigate and find the desired information.
- **Difficulty filling out forms:** Forms that are not properly designed for accessibility, such as missing form field labels or feedback for errors, can impede visually impaired individuals from successfully completing online forms.
- **Lack of descriptive text or audio description in video content:** When video content lacks descriptive text or audio descriptions, visually impaired individuals may not be able to fully comprehend the visual elements and context of the content.

These common challenges highlight the importance of addressing accessibility barriers to ensure a more inclusive and accessible online experience for visually impaired individuals.

4.2.2 Suggested Improvements for Enhanced Accessibility

- **Increased awareness of visually impaired users' needs:** Raising awareness among web developers and designers about the specific needs and challenges faced by visually impaired individuals can lead to more inclusive design practices.

- **Compliance with accessibility standards:** Adhering to recognized accessibility standards, such as WCAG 2.0, ensures that websites are designed and developed with accessibility in mind, making them more usable for visually impaired individuals.
- **More resources and support for visually impaired users:** Providing additional resources, such as assistive technologies, screen readers, or magnification tools, along with proper training and support, can empower visually impaired individuals to navigate and interact with online content more effectively.
- **Optimization for mobile devices:** As mobile devices are commonly used by visually impaired individuals, optimizing websites for mobile accessibility, including responsive design and intuitive navigation, can greatly improve their browsing experience.
- **Use of search engines optimized for visually impaired users:** Implementing search engines specifically designed for visually impaired users, with features like audio feedback or simplified interfaces, can enable more efficient and accurate search results.
- **Clear and specific search terms:** Encouraging visually impaired users to utilize clear and specific search terms can help them find relevant information more quickly and accurately.
- **Use of main headings and links for navigation:** Structuring web pages with clear and descriptive main headings, along with properly labeled and accessible links, facilitates easier navigation and content comprehension for visually impaired individuals.
- **Black background with white text option for better readability:** Providing an option for a black background with white text can enhance readability for visually impaired individuals, particularly those with light sensitivity.
- **Proper use of color contrast:** Ensuring sufficient color contrast between text and background improves readability for individuals with low vision or color blindness. This can be achieved by following accessibility guidelines and considering alternative design elements for conveying information.
- **Descriptive alt text for images:** Including descriptive alternative text for images allows screen readers to provide audio descriptions, enabling visually impaired users to understand the content of images that they cannot see.
- **Designing accessible websites is beneficial for all users:** Recognizing that designing accessible websites is not only the right thing to do but also a good business practice. It helps reach a wider audience, improve user experience, and benefits individuals with disabilities beyond visual impairments.

Implementing these improvements can significantly enhance the accessibility of websites and ensure a more inclusive online experience for visually impaired individuals.

4.3 Analysis

Based on the responses from the participants with diverse characteristics, these shed light on the difficulties experienced by visually impaired individuals. These difficulties include challenges in reading text, inadequate color contrast, poorly structured content, inaccessible forms or inputs, trouble identifying images or icons, navigating web pages, and completing forms. Additionally, the survey revealed the problem of encountering non-text content without suitable substitutes, emphasizing the need for alternative formats. The importance of raising awareness and adhering to accessibility standards was raised as well and the suggestions provided include making websites mobile-friendly, using search engines designed for visually impaired users, employing clear and specific search keywords, and utilizing main headings and links for navigation.

The interviewee also recommended using a black background with white font choice for improved reading experience. Collaboration between web developers, organisations, and the National Federation of the Visually Impaired was highlighted as a crucial factor in promoting accessibility and raising industry awareness.

Technical limitations, such as the lack of technical knowledge among visually impaired individuals, were identified as barriers to internet accessibility. The interviewee proposed organizing IT days to enhance members' technological skills and collaborating with companies specialising in accessibility solutions to address these limitations.

Compliance with accessibility standards and the establishment of rules and policies for internet accessibility were also emphasised as necessary measures. This includes funding research and development of technological solutions and increasing awareness and education about accessibility issues within the technology industry and society.

In conclusion, the findings demonstrate that visually impaired individuals face various challenges when using the internet. The importance of addressing these challenges through increased awareness, compliance with accessibility standards, optimization for mobile devices, customization options, and the establishment of rules and standards.

The suggested improvements, such as raising awareness among web developers, providing additional resources and support for visually impaired users, and optimizing websites for mobile accessibility, can contribute to a more inclusive and accessible online experience. By implementing these improvements and fostering collaboration between stakeholders, internet accessibility for visually impaired individuals can be significantly enhanced, leading to a more inclusive digital environment for all users.

4.3.1 Themes and patterns

We reviewed the responses to find themes, patterns, or related categories in the data. Based on the content or significance, we grouped similar responses together.

The following themes or categories emerged based on the findings:

Themes	Categories
Demographics	Age range, Gender identity
Visual Impairment	Difficulty reading text Difficulty identifying images or icons Difficulty filling out forms Difficulty navigating web pages
WCAG 2.0 Guidelines	Awareness of WCAG 2.0 Use of WCAG 2.0 for website evaluation Adequacy of WCAG 2.0 guidelines
Accessing Internet	Internet access device Difficulties related to visual impairment
Non-Text Content Accessibility	Encountering non-text content that couldn't be accessed
Accessibility Needs	inaccessible websites Non-text content
Specific Issues Encountered	Insufficient color contrast Poorly structured content Missing or incorrect alternative text for images Inaccessible forms or inputs

4.4 Themes analysis

Several themes emerged from the data, highlighting common issues and potential areas for improvement.

One prominent theme that emerged was the difficulties encountered by individuals with visual impairments when reading text and identifying images or icons. Insufficient colour contrast and missing or incorrect alternative text were identified as specific issues affecting website accessibility. Another related theme was the importance of clear and structured content, as poorly organised websites posed challenges for users with visual impairments.

While some participants were aware of these guidelines, there was a mixed perception of their adequacy in addressing the accessibility needs of individuals with visual impairments. Enhancing awareness and adherence to accessibility standards emerged as a potential solution to improve website accessibility.

Furthermore, the use of smartphones was mentioned as a convenient method for browsing the internet. However, it was also noted that not all individuals with visual impairments have access to the internet, indicating a digital divide that needs to be addressed.

The interview data provided additional perspectives on challenges faced by individuals with visual impairments. Difficulties with video content, job applications, and email usage were identified, with recommendations for providing descriptive text,

alternative application methods, and simple formatting to overcome these challenges. The need for collaboration between organisations, web developers, and policymakers was emphasised to raise awareness and improve accessibility.

In conclusion, the analysis revealed common challenges faced by individuals with visual impairments when accessing websites, such as difficulties with reading text, identifying images, and navigating poorly structured content. Adherence to accessibility guidelines, increased awareness, and technological advancements were identified as potential solutions. Collaboration and policy initiatives were also highlighted as necessary steps to promote web accessibility for individuals with visual impairments. By addressing these themes and implementing improvements, we can work towards a more inclusive and accessible online environment for all users.

4.4.1 Demographics (33 participants)

The survey had participants from diverse age ranges, with a majority falling between 25-34 years old. The gender distribution was balanced, emphasizing the importance of considering diverse perspectives in website accessibility efforts.

What is your age range?

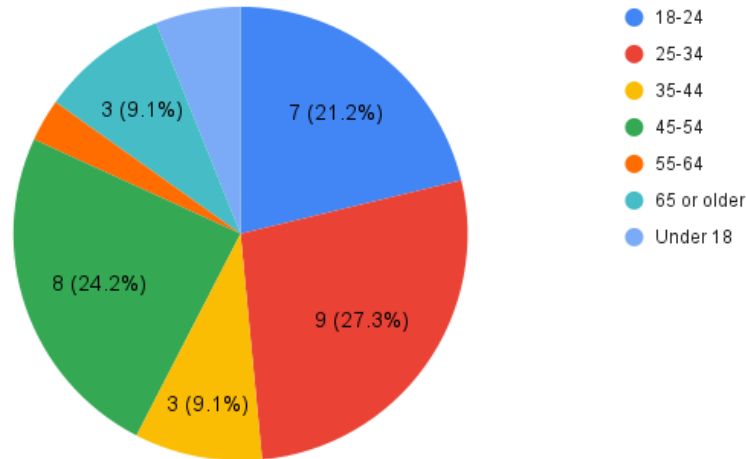


Figure 4.1: Age distribution

What is your gender identity?

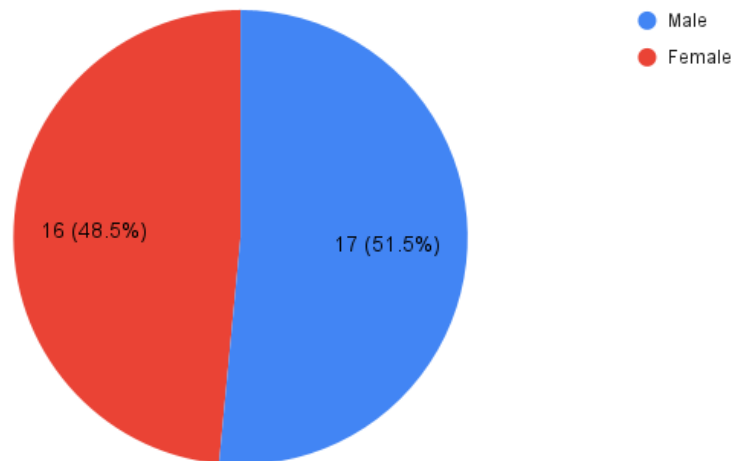


Figure 4.2: Gender distribution

4.4.2 Visual impairment

After filtering out responses from individuals without visual impairments, approximately 100% of the remaining respondents reported having a visual impairment. This statistic underscores the importance of gaining insights into the unique experiences of individuals with visual impairments.

4.4.3 Awareness of WCAG 2.0

The majority of respondents (48.5%) had not heard of WCAG 2.0 and were not familiar with WCAG 2.0, indicating a reasonable level of unawareness about web accessibility guidelines. Meanwhile, 36.4% of respondents had heard of WCAG, and 15.2% were unaware of WCAG.

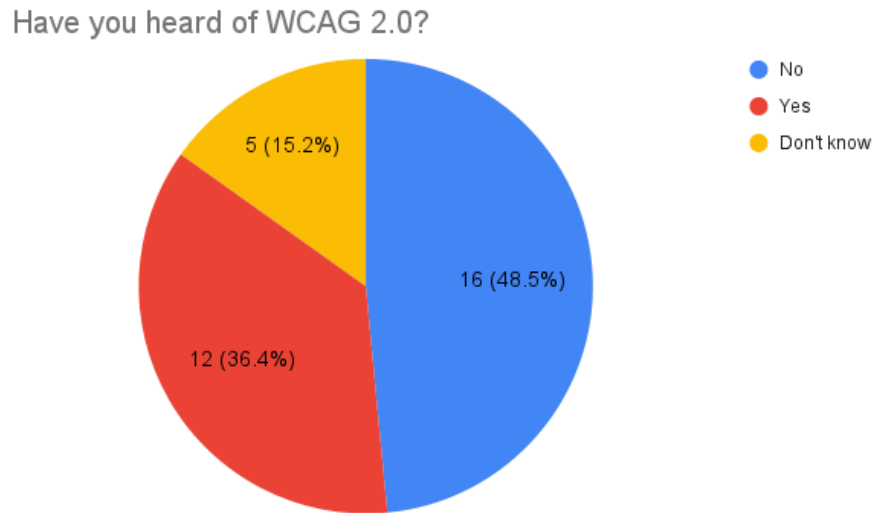


Figure 4.3: Awareness Of WCAG 2.0

4.4.4 Usage of WCAG 2.0 Guidelines

Only a portion of respondents reported using WCAG 2.0 guidelines for website evaluation, suggesting potential room for increased adoption to improve website accessibility.

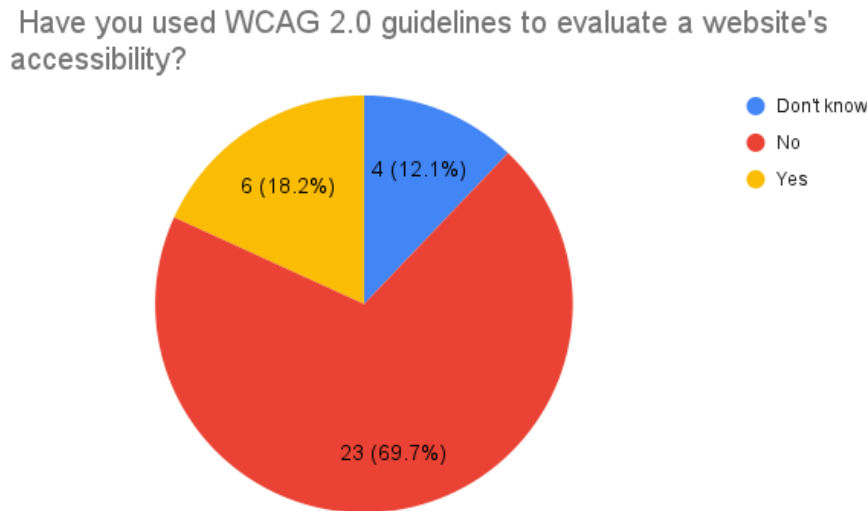


Figure 4.4: Used WCAG 2.0

4.4.5 Internet Access encountered difficulties

Desktops, laptops and smartphones were the most widely used devices to access the internet. There is a need for more accessible websites in these locations as some respondents reported having troubles in reading text, accessing web pages, recognizing graphics or icons, and filling out forms.

4.4.6 WCAG 2.0 Accessibility needs

- **Insufficient Color Contrast:** Several participants reported encountering websites with insufficient color contrast, making it difficult for individuals with low vision to perceive and distinguish content. This issue can impact readability and comprehension for users who rely on contrast for visual differentiation.
- **Inaccessible Forms:** A significant number of respondents mentioned encountering inaccessible forms on websites. Inaccessible forms can pose challenges for users with visual impairments, such as difficulties in inputting information, selecting options, or completing transactions. This issue emphasizes the importance of designing forms that are compatible with assistive technologies and providing alternative input methods.
- **Missing Alternative Text (Alt Text):** Some respondents noted instances where websites lacked proper alternative text (alt text) for images. Alt text is crucial for individuals using screen readers or other assistive technologies

How do you access the internet?

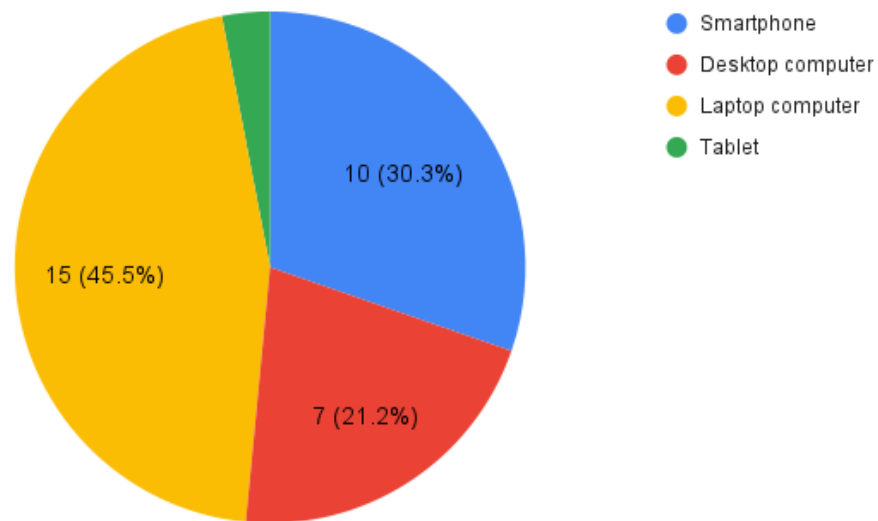


Figure 4.5: Access Internet

What difficulties do you encounter?

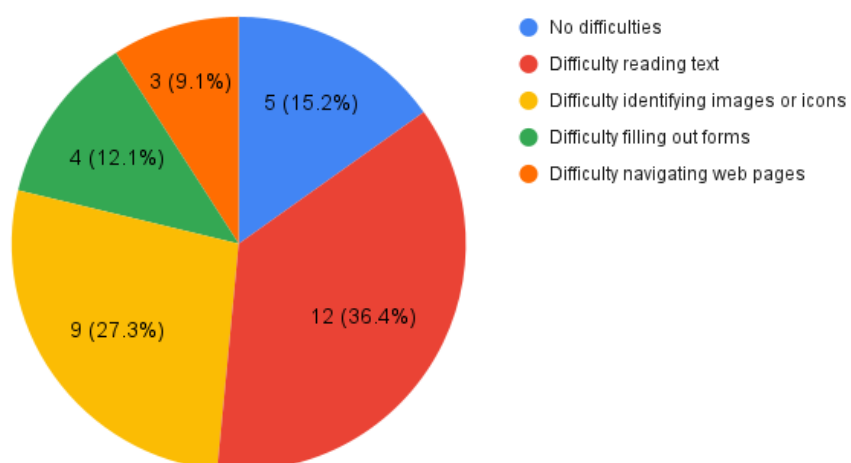


Figure 4.6: Difficulties Related to Visual Impairment

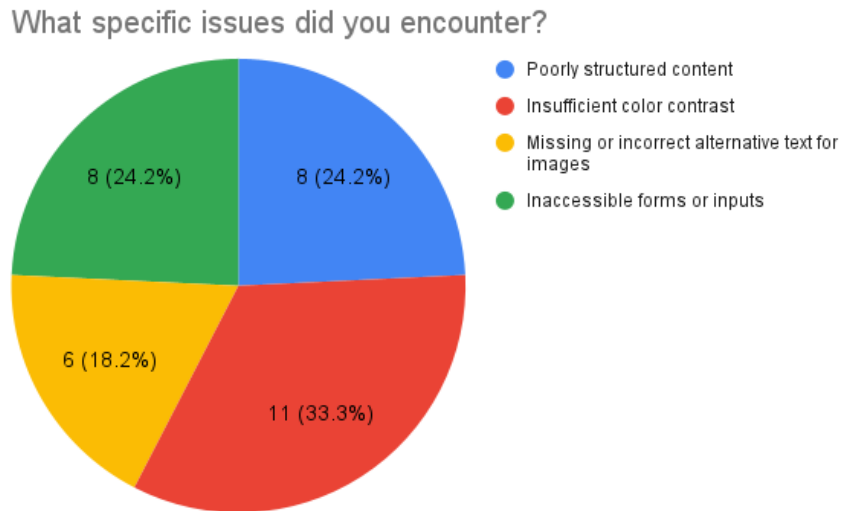


Figure 4.7: Specific Issues encountered

to understand the content and context of images. Without alt text, visually impaired users are unable to access the information conveyed through images, resulting in an incomplete browsing experience.

- **Poorly Structured Content:** Participants also reported encountering websites with poorly structured content. This issue includes elements such as illogical navigation, inconsistent layout, or confusing page structures. Poorly structured content can make it challenging for individuals with visual impairments to navigate websites effectively, locate desired information, or understand the content.

5.1 Discussion

RQ1: What are the specific needs of people with visual impairments when using the internet?

When using the internet, people with visual impairments have specific needs to ensure accessibility. Members of SRF [1] emphasized the importance of alternative text for images, clear and consistent headings, proper labeling of form elements, and well-structured content with appropriate heading levels. It is crucial for websites to provide accessible alternatives to visual information (WCAG 2.0 1.1.1 Non-text Content) [3].

This allows visually impaired individuals to understand the context and purpose of visual content. Proper heading structures (WCAG 2.0 1.3.1)

WCAG 2.0 1.3.1 states:

"Information, structure, and relationships conveyed through presentation can be programmatically determined or are available in text"

[3] and clear labeling of form elements (WCAG 2.0 3.3.2) [3] contribute to a well-organized and navigable web page, enabling visually impaired users to comprehend and interact with content effectively.

WCAG 2.0 3.3.2 states:

"Labels or instructions are provided when content requires user input."

RQ2: What obstacles do people with visual impairments face when accessing the internet?

People with visual impairments encounter various obstacles when accessing the internet. Low self-efficacy in using online learning platforms is a significant barrier for students with disabilities [6]. Additionally, inaccessible web design, such as missing or inadequate alternative text, improper heading structures, and complex navigation, hinders their ability to navigate and understand web content effectively [8].

RQ3: How well do the accessibility requirements of individuals with visual impairments align with the guidelines specified in WCAG 2.0???

The Web Content Accessibility Guidelines (WCAG 2.0) [3] is an established standard for web accessibility. However, WCAG 2.0 has limitations in fully addressing the needs of people with visual impairments. It was found that while WCAG 2.0 guidelines cover several accessibility aspects, they may not address all issues faced by

individuals with disabilities [5], [2]. It is important that the guidelines are improved continuously in order to keep up with evolving web technologies and user needs [7].

These challenges can be addressed by adhering to the WCAG 2.0 guidelines. WCAG 2.0's emphasis on clear text alternatives for non-text content (WCAG 2.0 1.1) [3], well-structured content (WCAG 2.0 1.3.1), and proper labeling of form elements (WCAG 2.0 3.3.2) [3].

challenges in interacting with video content, job searching and application processes, specific websites and online services, using email, and the need for political measures and initiatives to promote internet accessibility. These themes underscore the importance of providing audio descriptions or text alternatives, offering alternative application methods, addressing specific accessibility issues on websites and online services, and implementing regulations and standards at the policy level (WCAG 2.0, 1.2.1, 2.4.9, 3.3.2, 4.2.1) [3].

Chapter 6

Conclusions and Future Work

In conclusion, individuals with visual impairments have specific needs when using the internet, such as the use of assistive technologies and alternative text descriptions. However, they face various obstacles that hinder their access and engagement with digital content and services. The WCAG 2.0 guidelines provide a foundation for web accessibility, but there is room for improvement in terms of awareness, implementation, and testing.

To enhance the accessibility of websites for people with visual impairments, it is crucial for web developers and designers to adhere to design principles and adhere to accessibility standards. This can involve incorporating accessibility features, providing alternative text descriptions for visual content, ensuring sufficient color contrast, and optimizing website navigation. Continuous evaluation, monitoring, and user feedback are essential to identify and address accessibility barriers effectively.

By addressing the specific needs and obstacles faced by individuals with visual impairments and promoting the adoption of accessibility guidelines, we can create a more inclusive online environment that enables equal access and participation for all internet users.

In terms of work to be done in the future, more research could be conducted into how assistive technologies affects the quality of life for people who are visually impaired, evaluating the effectiveness of WCAG 2.1 guidelines, exploring user-centered design, assessing the impact of assistive technologies, Lastly, in the future, researchers could look into the social and cultural factors that lead to people with sight disabilities being left out and ignored.

References

- [1] Swedish Association of the Visually Impaired Blekinge and Kronoberg. <https://www.srf.nu/>.
- [2] M. A. Ahmed and M. Othman, “A study of wcag 2.0 guidelines for improving web accessibility for people with disabilities.”
- [3] B. Caldwell, M. Cooper, L. G. Reid, and G. Vanderheiden, “Web content accessibility guidelines 2.0,” *W3C Recommendation*, vol. 11, 2008.
- [4] R. S. Germano and I. Frango Silveira, “Wcag-easy tool : A tool based in the wcag to learn web accessibility,” in *2022 17th Iberian Conference on Information Systems and Technologies (CISTI)*, 2022, pp. 1–6.
- [5] W. A. R. W. M. Isa, A. I. H. Suhaimi, N. Ariffn, N. F. Ishak, and N. M. Ralim, “Accessibility evaluation using web content accessibility guidelines (wcag) 2.0,” in *2016 4th International Conference on User Science and Engineering (i-USEr)*, 2016, pp. 1–4.
- [6] O. E. Lee, S. Y. Kim, and T. Gezer, “Factors associated with online learning self-efficacy among students with disabilities in higher education,” *The American Journal of Distance Education*, vol. 35, no. 4, pp. 293–306, 2021.
- [7] H. A. Li, J. Li, and J. Ni, “Wcag 2.0: The future of web accessibility.”
- [8] K. I. Roumeliotis and N. D. Tselikas, “Evaluating progressive web app accessibility for people with disabilities,” *Network*, vol. 2, no. 2, pp. 350–369, 2022.
- [9] G. Santucci, “Vis-a-wis: Improving visual accessibility through automatic web content adaptation,” in *Universal Access in Human-Computer Interaction. Applications and Services*, C. Stephanidis, Ed. Berlin, Heidelberg: Springer Berlin Heidelberg, 2009, pp. 787–796.
- [10] C. B. Seaman, “Qualitative methods in empirical studies of software engineering,” *IEEE Transactions on software engineering*, vol. 25, no. 4, pp. 557–572, 1999.

What is your age range?

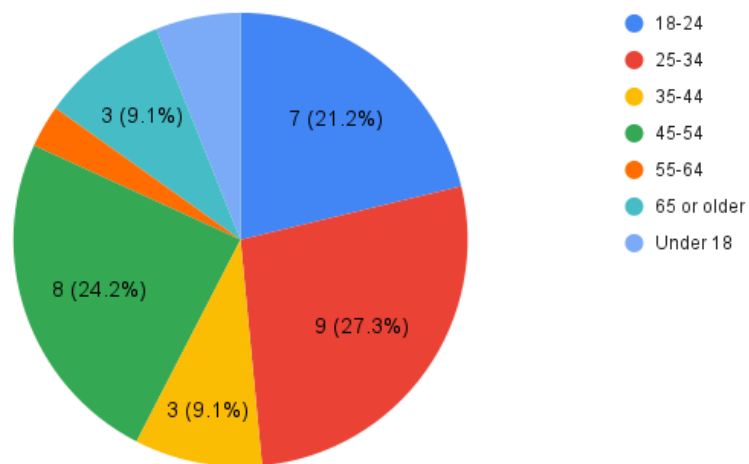


Figure A.1: Age distribution

What is your gender identity?

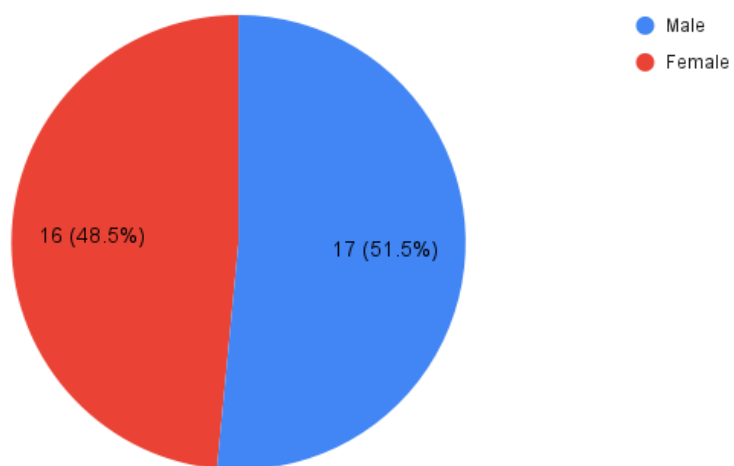


Figure A.2: Gender

Have you heard of WCAG 2.0?

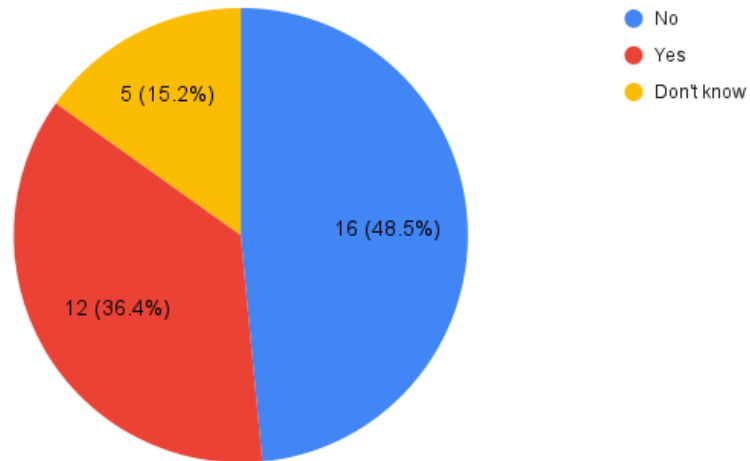


Figure A.3: Awareness Of WCAG 2.0

Have you used WCAG 2.0 guidelines to evaluate a website's accessibility?

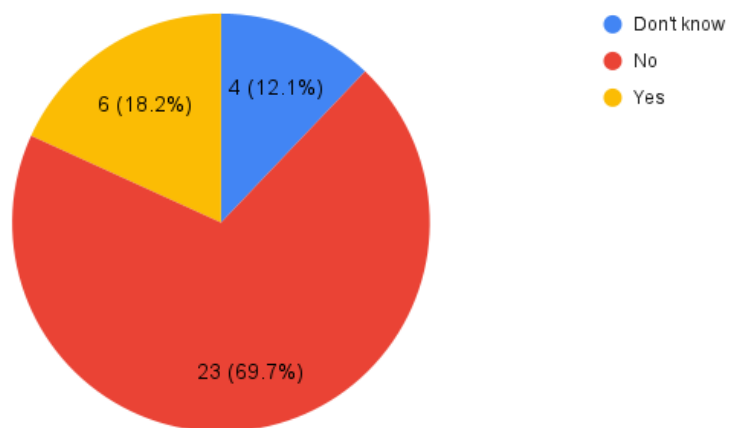


Figure A.4: Used WCAG 2.0

How do you access the internet?

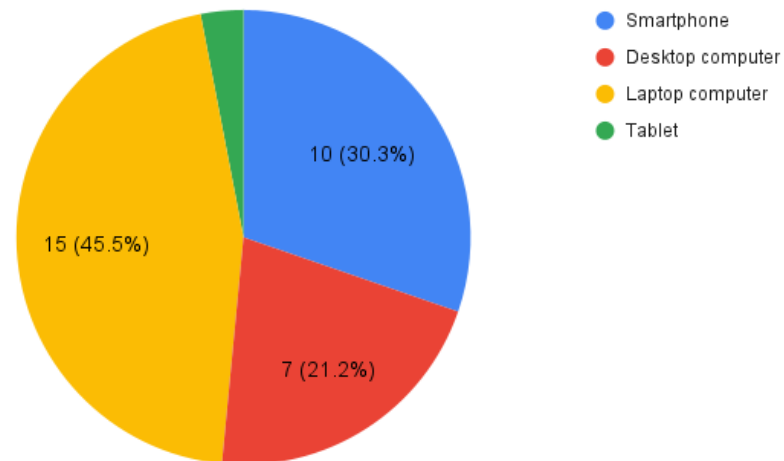


Figure A.5: Access Internet

What difficulties do you encounter?

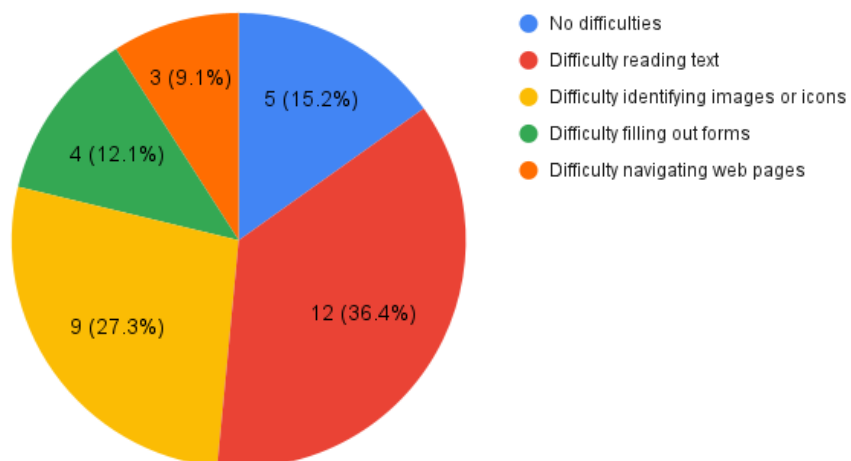


Figure A.6: Difficulties Related to Visual Impairment

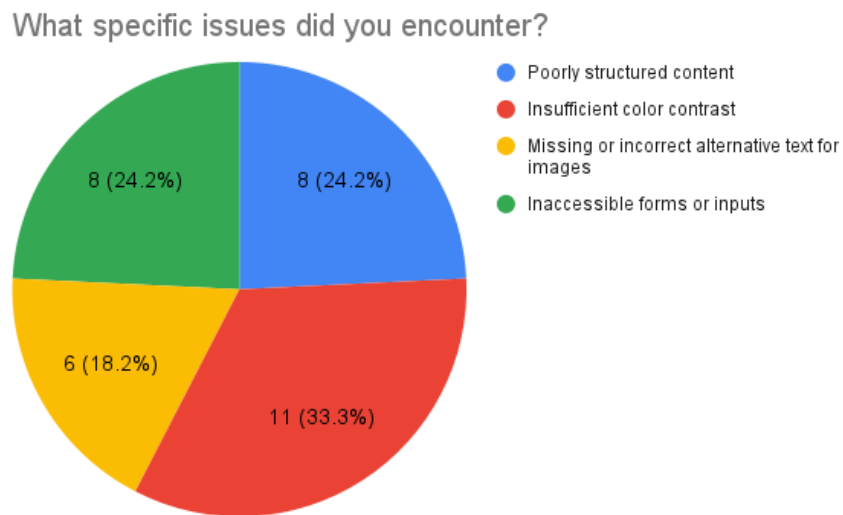


Figure A.7: Specific Issues encountered

Survey on WCAG 2.0(Web Content Accessibility Guidelines)

Welcome to our survey on web accessibility! This survey is aimed at collecting information about users' experiences with web content accessibility, specifically with regard to the Web Content Accessibility Guidelines (WCAG) developed by the World Wide Web Consortium (W3C). The results of this survey will be used to identify areas where improvements can be made to make web content more accessible to all users.

All responses to this survey are completely anonymous and will be kept confidential. The data collected from this survey will be analyzed and used only for research purposes.

If you have any questions or comments regarding this survey, please feel free to contact us at beha20@student.bth.se, isa20@student.bth.se .

Thank you for taking the time to participate in our survey. Your feedback is greatly appreciated!

* Indicates required question

1. What is your age range?

Mark only one oval.

- Under 18
- 18-24
- 25-34
- 35-44
- 45-54
- 55-64
- 65 or older
- Prefer not to answer

2. What is your gender identity?

Mark only one oval.

- Female
- Male
- Non-binary/genderqueer
- Prefer to self-describe (please specify)
- Prefer not to answer

3. Do you have a visual impairment?

Mark only one oval.

- Yes
- No
- Prefer not to say

4. Have you heard of WCAG 2.0?

Mark only one oval.

- Yes
- No
- Don't know
- Other: _____

5. If you answered "Yes" to a previous question, have you used WCAG 2.0 guidelines to evaluate a website's accessibility?

Mark only one oval.

- Yes
- No
- Don't know

6. How do you access the internet?

Mark only one oval.

- Desktop computer
- Laptop computer
- Tablet
- Smartphone
- Other: _____

7. When accessing the internet, do you encounter any difficulties related to your visual impairment?

Mark only one oval.

- Yes
- No
- Other: _____

8. If you answered "Yes" to a previous question , what difficulties do you encounter?

Mark only one oval.

- Difficulty reading text
- Difficulty identifying images or icons
- Difficulty navigating web pages
- Difficulty filling out forms
- No difficulties
- Other: _____

9. Have you ever encountered non-text content on a website that you couldn't access? *

Mark only one oval.

- Yes, because there was no text description.
- Yes, because the text alternative provided was insufficient.
- No, I have not encountered non-text content that I couldn't access.
- I don't know.
- I prefer non-text content and do not need text alternatives.

10. Do you think the WCAG 2.0 guidelines adequately address the accessibility needs of people with visual impairments?

Mark only one oval.

- Yes
- No
- Unsure

11. In your experience, have you encountered any websites that did not meet the accessibility needs of people with visual impairments? *

Mark only one oval.

- Yes
- No
- Don't know

12. If you answered "Yes" to a previous question, what specific issues did you encounter?

Mark only one oval.

- Insufficient color contrast
- Inaccessible forms or inputs
- Missing or incorrect alternative text for images
- Poorly structured content
- Other: _____

13. Do you have any additional comments or feedback related to the accessibility of websites for people with visual impairments

This content is neither created nor endorsed by Google.

Google Forms

Benaris: Vilka är de vanligaste problemen som synskadade personer stöter på när de använder internet?

Person 1: Några vanliga problem inkluderar svårigheter att läsa text och brist på tillgängliga alternativ för anpassning av webbsidor.

Person 2: Det skulle vara till hjälp med mer användning av mjukare färger för att underlätta läsbarheten för synskadade.

Benaris: Vad är några förbättringar som skulle kunna göra det lättare för synskadade att använda internet mer effektivt och självständigt?

Person 1: Förbättring av tillgängligheten på internet för synskadade skulle innebära att fler personer kan få tillgång till och använda internet på ett effektivt och självständigt sätt. Det skulle kräva ökad medvetenhet om behoven hos synskadade användare under utvecklingen av webbsidor och teknologiska lösningar. Vi behöver också följa tillgänglighetstandarderna och tillhandahålla fler resurser och stöd för synskadade användare att navigera på internet och använda tekniska hjälpmedel.

Person 2: Det är också viktigt att komma ihåg att inte alla synskadade har tillgång till internet.

Ismail: Hur kan synskadade personer söka information på ett effektivt sätt på internet, via mobilen eller datorn?

Person 2: För det mesta använder jag mobilen för att söka information på internet.

Person 1: Mobiltelefoner är smidiga och minskar krånglet, särskilt för de som inte är bekanta med datorer och teknik. Några tips är att använda sökmotorer som är optimerade för synskadade, använda korta och specifika söktermer samt navigera på webbsidor med hjälp av huvudrubriker och länkar. Dessutom har svart bakgrund med vit text fungerat mycket bättre för synskadade, och det skulle vara till hjälp om varje webbsida hade en knapp för att växla till ett sådant läge.

Benaris: Hur kan Synskadade Riksförbundet arbeta för att öka medvetenheten om de utmaningar som synskadade personer står inför när de använder internet och förbättra tillgängligheten på internet?

Person 2: Cirka 80% av synskadade personer är tekniskt begränsade, så det finns en möjlighet att öka medvetenheten och samarbeta med webbutvecklare. SRF brukar organisera IT-dagar med företagen

"IRIS hjälpmedel" och "Polar print" för att öka kunskapen om IT bland våra medlemmar. Några andra åtgärder som kan vidtas är att samarbeta med webbutvecklare och andra organisationer för att öka medvetenheten om tillgänglighetsfrågor samt att utbilda synskadade användare i att använda tillgänglig teknologi.

Benaris: Vilka är de främsta hindren för att göra internet mer tillgängligt för synskadade personer och hur kan dessa hinder övervinnas?

Person 1: De främsta hindren för att göra internet mer tillgängligt för synskadade inkluderar bristande efterlevnad av tillgänglighetsstandarder, bristande medvetenhet om tillgänglighetsfrågor, tekniska begränsningar och kostnadsbegränsningar. Dessa hinder kan övervinnas genom att öka medvetenheten och utbildningen kring tillgänglighetsfrågor, genom att utveckla nya teknologiska lösningar och genom att införa regler och standarder för tillgänglighet på internet.

Ismail: Hur kan synskadade personer interagera med videoinnehåll på internet och vad är de vanligaste utmaningarna?

Person 2: Några utmaningar kan inkludera svårigheter att höra ljudet eller att förstå visuellt innehåll som saknar beskrivande text eller ljudbeskrivning. Lösningar kan inkludera att tillhandahålla ljudbeskrivning eller textalternativ för synskadade användare.

Ismail: Vilka utmaningar kan synskadade personer möta när de söker och ansöker om jobb på internet?

Person 1: Det kan vara svårt att navigera på karriärsidor och att ladda upp CV:n och andra dokument. Det är bättre om de kan erbjuda alternativa metoder, som att tillåta ansökan via e-post eller post.

Ismail: Vilka specifika webbplatser och onlinetjänster som är svåra för synskadade personer att använda och varför?

Person 2: sociala medieplattformar som Facebook och Twitter, e-handel, webbplatser som Amazon och online-banktjänster. Anledningen till svårigheterna kan vara bristande tillgänglighetsfunktioner, dålig kontrast och användarvänlighet.

Benaris: Vilka utmaningar kan synskadade personer möta när de använder e-post och hur kan dessa utmaningar övervinnas?

Person 1: Några möjliga utmaningar inkluderar svårigheter att läsa e-postmeddelanden och att skriva och formatera svar. Lösningar kan innefatta användning av skärmläsare och enkel formatering.

Benaris: Vilka politiska åtgärder och initiativ behövs för att främja tillgängligheten på internet för synskadade personer?

Person 2: Några nödvändiga politiska åtgärder och initiativ inkluderar att införa regler och standarder för tillgänglighet på internet, att tillhandahålla finansiering för forskning och utveckling av nya teknologiska lösningar samt att öka medvetenheten och utbildningen kring tillgänglighetsfrågor inom teknikindustrin och samhället som helhet.

Participant Consent Form

This template is designed primarily for those doing qualitative interviews with adults from non-vulnerable populations and dealing with non-sensitive topics.

The form would be different in the case of focus groups or quantitative research. If conducting research with vulnerable populations and / or sensitive topics please see Research Ethics Committee website for further details.

The points listed on the template below are for illustration only. You may alter the wording to suit your project as you see fit.

A consent form is not simply about a person giving you permission to involve them in research, it is an agreement between the researcher and the research participant outlining the roles and responsibilities they are taking towards one another throughout the whole of the research process.

The researcher should retain one copy of the consent form signed by both themselves and the participant. The participant should also be given a copy of the consent form as a record of what they have signed up to.

Even if a person has signed a consent form consent should still be re-established at the point of doing the interview.

Template

[*Title of project*]

Consent to take part in research

- I..... voluntarily agree to participate in this research study.
- I understand that even if I agree to participate now, I can withdraw at any time or refuse to answer any question without any consequences of any kind.
- I understand that I can withdraw permission to use data from my interview within two weeks after the interview, in which case the material will be deleted.
- I have had the purpose and nature of the study explained to me in writing and I have had the opportunity to ask questions about the study.
- I understand that participation involves...[*outline briefly in simple terms what participation in your research will involve*].
- I understand that I will not benefit directly from participating in this research.
- I agree to my interview being audio-recorded.
- I understand that all information I provide for this study will be treated confidentially.
- I understand that in any report on the results of this research my identity will remain anonymous. This will be done by changing my name and disguising any details of my interview which may reveal my identity or the identity of people I speak about.
- I understand that disguised extracts from my interview may be quoted in...[*list all forum in which you plan to use the data from the interview: dissertation, conference presentation, published papers etc.*].

- I understand that if I inform the researcher that myself or someone else is at risk of harm they may have to report this to the relevant authorities - they will discuss this with me first but may be required to report with or without my permission.
- I understand that signed consent forms and original audio recordings will be retained in [*specify location, security arrangements and who has access to data*] until [*specific relevant period – for students this will be until the exam board confirms the results of their dissertation*].
- I understand that a transcript of my interview in which all identifying information has been removed will be retained for [*specific relevant period – for students this will be two years from the date of the exam board*].
- I understand that under freedom of information legalisation I am entitled to access the information I have provided at any time while it is in storage as specified above.
- I understand that I am free to contact any of the people involved in the research to seek further clarification and information.

Names, degrees, affiliations and contact details of researchers (and academic supervisors when relevant).

Signature of research participant

Signature of participant

Date

Signature of researcher

I believe the participant is giving informed consent to participate in this study

Signature of researcher

Date

