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A comprehensive accessibility assessment process: the case of the user-based Accessibility Qualifier tool

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Abstract. Web accessibility continues to be a pending issue in software engineering, despite the existence of web accessibility legislation in many countries. This situation violates the rights of persons with disabilities (PwD) to access information and causes negative emotional consequences such as frustration, anguish and anger. Lack of web accessibility not only excludes PwD, but also perpetuates their invisibility and limits their active participation in society. Traditional web accessibility evaluations often focus exclusively on technical and normative criteria, without effectively integrating the perception and experience of PwD. This leads to websites that may comply with formal standards, but not necessarily with the real needs of PwD. This article presents the evaluation of the Accessibility Qualifier (AQ), a tool designed to allow PwD to assess the level of accessibility of the websites they visit, from their experience and perception. AQ allows PwD to express their voice and emotions in the face of digital barriers. The evaluation of the AQ, carried out through enquiry methods, usability tests and focus groups, led to significant findings in terms of both compliances with regulations and user experience, and provided the basis for improving the quality of the tool. The use of the AQ empowers PwD becoming active contributors in identifying and reporting the lack of web accessibility. In addition, it provides valuable information for those responsible for the qualified websites, enabling a deeper understanding of the impact that lack of accessibility has on PwD, and thus promoting the development of a more inclusive and non-discriminatory web.

Keywords: Disability, Usability Evaluation Methods, User Experience, WCAG, Web Accessibility

1   Introduction

Web accessibility is the extent to which websites and web applications can be used by people from a population with the widest range of user needs, characteristics and capabilities to achieve identified goals in identified contexts of use [1]. Web accessibility becomes an indispensable condition for preventing marginalization and social

exclusion, especially of PwD and of other vulnerable communities, even further in an increasingly digitally interconnected world.

Although laws and regulations promoting digital accessibility exist in most countries and regions, especially for public administration websites [2], their implementation remains uneven, insufficient and often it is absent. In the 2025 edition of the annual report of WebAIM on the accessibility status of 1 million websites [3], 94.8% of homepages with accessibility problems were detected, decreasing by only 3.1% from 97.8% of the first edition from 2019. In this study, the WAVE[1] web accessibility evaluation tool was used for detecting Web Content Accessibility Guidelines 2.2 (WCAG) conformance failures [4].

Lack of accessibility not only generates barriers in accessing web content, information, services and functionalities provided on websites, but also has an emotional impact on people who feel marginalized [5]. In a previous study [6] in which 53 PwD were consulted about their experiences of using Argentinean websites for their daily tasks and procedures, out of 109 experiences of use commented on, only 19 (17.43%) were successful, so they could complete the procedures alone without difficulty. In the rest of the cases, they could not complete the tasks in mind (35.77%), or they did them but with great difficulty (46.78%), asking for help and losing their autonomy. All PwD expressed subjective and emotional issues such as indignation, frustration, anguish or annoyance for this situation and also for not having any means of complaint within the inaccessible visited websites.

The Accessibility Qualifier (AQ) is an accessible digital tool that allows PwD to qualify the web accessibility of the website that they visit, according to their perception and experience [7]. The tool permits PwD to express their opinions and feelings, and to make their claims visible. It consists of two components: a browser extension available to all users who participate as qualifiers, and a web application for administration and management of the database of qualifications, complaints and opinions.

The aim of this article is to explain the evaluation process of the browser extension of the AQ tool, both in terms of the accessibility regulations it must comply with and the impact it has on PwD when they use it. The evaluation of the AQ tool is an essential source of information to improve it and to guarantee the development of a quality technological tool, in accordance with the importance of the problem to be solved.

Web accessibility of the AQ tool was assessed via automated and manual tests, in compliance with regulations and across diverse interaction scenarios. To evaluate the tool from user perspective, usability methods [8] were carried out such as usability tests, system usability scale (SUS) questionnaire and focus groups.

With respect to the structure of this article, firstly an introduction of the AQ tool is presented. The sections 2 and 3 explain the evaluation carried out, the sample of users, the survey instruments, and the results obtained. Finally, main findings and conclusions are included.

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[1]Official website of WAVE Web Accessibility Evaluation Tool: wave.webaim.org

2   The Accessibility Qualifier tool overview

The AQ [7] is an accessible digital tool that allows PwD to qualify and evaluate the accessibility of a visited website according to their perception and experience using it. PwD are able to qualify and give an opinion on the perceived accessibility and also they can observe the qualifications of others.

The development of the AQ tool was inspired by findings from research conducted with PwD [6], who expressed how the lack of web accessibility affects their lives emotionally. It also aims to help address the widespread issue of inaccessible websites, as highlighted in multiple studies [3][9].

The AQ consists of two components: a browser extension available to all users who participate as qualifiers, and a web application for the management of the database of qualifications, reviewing and accepting the complaints and opinions expressed by PwD, for the administrator profile. Screenshots of both components are shown in Fig. 2 (a) and (b), respectively.
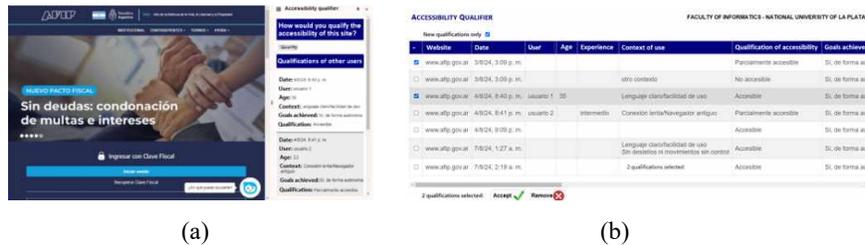

(a)	(b)

Fig. 1. (a) Main screen of the AQ browser extension. (b) AQ administration homepage.

Upon activation or page change, the Qualifier profile retrieves from the server an HTML form for submitting a new qualification and displays existing qualifications from other users. The form to make an accessibility qualification of the visited website, consists of three sections available to PwD. The first section of the form, asks about the qualifier's profile such as name/nickname, age and knowledge level of Internet, and the context of use and interaction, such as the assistive technologies required. In the other sections, as it is shown in figure Fig. 3 (a), (b) and (c), it permits PwD to express how the experience of accessing and using the website was, to specify the qualification of the perceived accessibility, and to complete on subjective issues, opinions and feelings.

(a)	(b)	(c)

Fig. 2. (a) PwD experience (b) Accessibility Qualification and (c) Subjective issues sections.

PwD can perform a more detailed evaluation using the "Advanced qualification" option, which allows them to report issues related to perception, operability, comprehension, or robustness. They may also add personal impressions in the "Subjective/personal observation" field and choose to share their comments with web managers (if contact is available) and/or with other users through the tool.

3 Evaluating the Accessibility Qualifier tool from an expert point of view

3.1 Automatic accessibility evaluation

Experts evaluated the AQ browser extension from a technical and regulatory perspective using WCAG 2.1 (levels A and AA) and the WAVE tool (v3.2.7.2). As shown in Fig. 7, the evaluation reported zero accessibility errors.
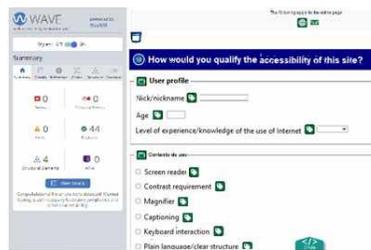

Fig. 3. WAVE results of browser extension with 0 accessibility errors.

3.2 Manual accessibility checks

Manual checks were performed on the AQ browser extension across various interaction scenarios, including screen reader (NVDA), keyboard-only navigation, mouse and virtual keyboard use, screen magnification, and high contrast. The extension functioned correctly in all cases, though magnification caused some form fields to misalign with their labels—a detail to be corrected in future versions.

4 Evaluating the accessibility of the Accessibility Qualifier tool from the perspective of people with disabilities

4.1 Usability test of the tool by PwD

As part of the AQ accessibility evaluation, various in-person UCD techniques were carried out [10] to enable direct observation of participants' expressions and better support novice users. In the user testing [11], 16 PwD participated included 3 blind people, 2 with visual impairment, 3 deaf people, 1 person who was an exclusive user keyboard because the mouse worsens his neurological condition, 1 with dyslexia, 2

people with autism, as well as 4 older adults. PwD have to perform 5 tasks that covered core AQ functions: viewing the opinions of other PwD (Task 1), filling out their profile (Task 2), qualifying the website generally and in depth (advanced option) (Tasks 3 and 4), and submitting personal feedback (Task 5). Computers were adapted to individual needs and the deaf people were assisted by an Argentinean Sign Language Interpreter (ILSA). Performance was recorded based on task completion levels: without difficulty (WoD), with difficulty (WD), with assistance (WA), or not completed (NC), with results shown in Table 1.

Table 1. Usability test by PwD.

User profile	Interaction requirements	Task 1	Task 2	Task 3	Task 4	Task 5
Maximiliano V. 34 years old. Blind.	Screen reader and sequential navigation	WoD	WD	WoD	WD	WoD
Tomás F. 26 years old . Blind.	Screen reader and sequential navigation	WoD	WoD	WoD	WA	WoD
Andrés G. 31 years old. Blind.	Screen reader and sequential navigation	WoD	WoD	WoD	WoD	WoD
Andrea B. 38 years old. Visual impairment.	200 % of magnification	WA	WoD	WoD	WoD	WoD
Martin F.M. 45years old. Visual impairment.	200 % of magnification	WA	WoD	WoD	WoD	WoD
Eve D.41 years old. Motor disability	Sequential navigation	WoD	WoD	WoD	WoD	WoD
Ignacio, L. 25 years old. Deaf.	Plain and comprehensible language. Subtitles	WoD	WoD	WoD	WoD	WoD
Emilio, P. 33 years old. Deaf.	Plain and comprehensible language. Subtitles	WoD	WoD	WoD	WH	WA
Dardo, S. 36 years old.Deaf.	Plain and comprehensible language. Subtitles	WoD	WoD	WoD	WoD	WA
María Inti. 29 years old.Dyslexia.	Good contrast. Plain and comprehensible language.	WoD	WoD	WoD	WA	WoD
Nicolás F. 28 years old.Autism.	Plain and comprehensible language.	WoD	WoD	WoD	WoD	WA
Fausto C.ᵉ.34 years old.Autism.	Plain and comprehensible language.	NC	WoD	WoD	WA	WA
Olga S. 72 years old.	Good contrast Legible typography Plain and comprehensible language	WoD	WoD	WoD	WoD	WoD
Azucena S. 77 years old.	Good contrast. Legible typography Plain and comprehensible language	WA	WoD	WoD	WA	WA
Oscar C. 78 years old.	Good contrast. Legible typography. Plain and comprehensible language	WA	WoD	WoD	WA	WA
Elizabeth H. 71 years old.	Good contrast. Legible typography Plain and comprehensible language	WoD	WoD	WoD	WoD	WoD

It should be noted that of the 80 tasks performed, 66 (82.5%) were performed without difficulty, 13 tasks (16.25%) were performed with assistance and 1 task was not performed because the participant did not want to.The request for assistance involved the need for PwD to have their comments and inputs reviewed by the evaluation team.

4.2 Evaluation of the user experience according to the SUS satisfaction questionnaire

At the end of the user testing, the 16 PwD were invited to complete a SUS questionnaire [12] about the AQ browser extension and after that, they were invited to participate in a focus group [13] to discuss their experience together. SUS is a free 10-item questionnaire with 5 response options based on the Likert scale. It has become a widely used tool by designers, researchers and UX practitioners [14].

For the evaluation of the AQ browser extension, the SUS questions were adapted to the specific software under evaluation. In accordance with the methodology and scoring system of SUS, the final score is derived by converting user responses into numerical values. For positively worded items (questions 1, 3, 5, 7, and 9), the scoring is as follows: *Strongly disagree* = 0 points, *Disagree* = 1 point, *Neutral* = 2 points, *Agree* = 3 points, and *Strongly agree* = 4 points. For negatively worded items (questions 2, 4, 6, 8, and 10), the scoring is reversed. The scores for all items are then summed, and the total is multiplied by 2.5 to yield a final SUS score ranging from 0 to 100. The results are shown in Table 2.

Table 2. SUS questionnaire results.

Question	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree	Score
1. I think that I would like to use the AQ frequently.	0	1	5	5	4	42
2. I found the AQ unnecessarily complex.	7	9	0	0	0	54
3. I thought the AQ was easy to use.	0	0	3	8	5	50
4. I think that I would need the support of a technical person to use this tool.	5	11	0	0	0	53
5. I found the various functions in AQ were well integrated.	0	0	1	1	14	61
6. I thought there was too much inconsistency in this tool.	10	6	0	0	0	58
7. I would imagine that most PwD would learn to use this tool very quickly.	0	0	0	3	13	61
8. I found the AQ very cumbersome to use.	7	8	1	0	0	54
9. I felt very confident using the tool.	0	0	0	8	8	56
10. I needed to learn a lot of things before I could use this tool.	5	8	3	0	0	50

To interpret the result of SUS, the higher the total score the more usable the tool is. Values above 68 are considered a good usability score. In this case, the total score for the AQ tool, taking into account the participation of 16 PwD, was: 84.21. Some findings observed in this evaluation were:

- In question 1, some PwD (older adults, deaf and blind people), argued that they wouldn't like to use the AQ tool because they do not like to complain.

- PwD using a magnifier struggled to find others' opinions in question 2 due to multiple scroll pages.
- In question 3, older adults and PwD with autism found the AQ extension simple but felt that qualifying or evaluating was not easy.
- Some concepts such as "inconsistency" and "cumbersome" used in the SUS questionnaire, had to be explained to PwD with autism and deaf people.
- Questions such as questions 2, 4 and 6 were perceived as ambiguous, not very concise and complex to interpret by PwD.
- Several PwD, especially older adults and autistic users, found SUS questions 2, 3 and 7 that appeared to ask the same thing, albeit phrased differently. Also, with questions 8 and 10. Clarification with concrete examples was needed to ensure understanding.

The SUS was used in the AQ extension's accessibility evaluation due to its speed and widespread use in UX research [14]. It was applied alongside other user testing and inquiry methods to enrich and complement the evaluation.

4.3 Focus group evaluation

The focus group [15] was carried out with the aim of receiving and sharing feedback from the PwD, to know their opinions and comments regarding the AQ browser extension for qualifier profile. Ten PwD participated in the focus group, who had already participated in the user testing and in the SUS questionnaire. Among them were 3 blind people, 2 visually impaired people, 2 deaf people, 1 keyboard-only user and 2 older adults. The remaining 6 PwD could not stay in the session.

The triggering questions to start the debate and encourage participation were: "*Do you find it is useful to have a tool like the AQ to express opinions and complaints?", "Would you install it in your browser to use it when necessary?", "What do you feel to have such tool?",* and *"What improvements would you make to it?".*

The key findings from the PwD interventions are outlined below:

- All PwD agreedthat the AQ is a very useful tool and that they would use it mainly to make a complaint and share what they felt and experienced.
- All agreed that they feel satisfied, thankful and encouraged by having a tool that allows them to express and externalize what they feel, and let the rest of the users know about the experience they had so that it does not happen again.
- 8 PwD stressed the importance of not requiring completion of the form because it can be used simply to look at qualifications and opinions of the website made by others who have experienced its use and access.
- 3 PwD said that it would be useful to have an explanation or guidance on the weight of the comments and claims made, for example if the qualification has a legal value.
- All highlighted the need for a glossary of terms and phrases related to accessibility in order to formulate appropriate opinions and justify the claims made.
- 6 PwD expressed the need to have default sentences in the opinion section.

- 8 PwD agreed that being able to observe the opinions and qualification of others is interesting and useful, but it would be important to be able to filter out those that come from people with the same disability, demands and needs as oneself.

Regarding the improvements to be considered, 4 PwD suggested that the tool should inform if the comments and qualifications were received by those responsible for the website in order to follow up. Seven PwD asked if it is possible to know the e-mails of the other users in order to gather signatures and join in a collective complaint. All of them agreed that it would be important to have the possibility to review the qualification o claimsalready issued and to be able to modify it after having sent it.

5   Discussion

The AQ specifically the version of the browser extension developed for the qualifier user profile was exposed to an intensive and comprehensive accessibility evaluation process. Both technical and UX perspectives were taken into account. Important UCD evaluation techniques were used, involving experts and PwD with different profiles, ages and disabilities. After an exhaustive analysis of the results of the different evaluations carried out, the following findings can be summarized:
   Regarding usability testing results:

- It was difficult to evaluate the accessibility of the AQ browser extension which in turn is a tool that evaluates the accessibility of websites, especially for first-time respondents who had not participated in other usability evaluation methods. It must be explained that it was not the evaluation of the website in question that mattered, but of the tool that allowed them to qualify it and give their opinion on it.
- Lack of knowledge of the CRPD and of the principles of the WCAG standards was detected. Blind and deaf people were more aware of these regulations. Elderly and people with autism had difficulties in this regard.
- When choosing their requirements or supports required in the context of use, plain language and clear structure were chosen by the majority regardless of disability and age.

With respect to the SUS questionnaire, several interpretations or confusions were detected that required explaining each question and reformulating it. It was not easy for PwD to understand, interpret and complete the SUS questionnaire. It took a long time to carry it out due to the queries or doubts that arose. Many questions were not understood mainly by the elderly, people with autism and deaf people, since they are compound, negated and require understanding of propositional logic. Other considerations include:

- Interpretation costs were detected for some of the questions that are compound. Certain SUS questions were perceived by PwD as very long, confusing and not very concise, making them difficult to read and understanding.
- Cognitive overload was required to understand the meaning of applying the possible Likert scale to the question asked. Mainly in the questions with negations. For

example, "strongly disagree about finding the AQ unnecessarily complex" was difficult to understand for deaf people, people with autism and older adults. These had to be explained several times, and PwD required help to answer.

- The range of 5 answer options of the Likert scale was also difficult for PwD. People with autism and deaf people found it difficult to distinguish the differences between "strongly disagree" and "disagree". It would have been better to work with 3 more concrete and unambiguous options.
- There were problems of interpretation, since syntactic issues being evaluated were confused with semantic issues of the application domain. In question 1 about whether you would like to use the AQ tool assiduously, no one would like to claim permanently. It was difficult to interpret this question as positive.
- When question 3 asks whether they need expert support to use the AQ tool, some were confused because they did not need support to use the tool but they needed someone to review their opinions before submitting the form. Deaf people and people with autism found it difficult to express their feelings and thoughts about using inaccessible websites.
- In question 10, about needing to learn a lot of things to manage the AQ tool, they were confused with learning some concepts about accessibility, not about using the tool itself.

The previous analysis of the SUS questionnaire used by PwD suggests that the usability questionnaires should be made more accessible by making the questions simpler, formulated in an active voice and written in a simple and direct way. It would be important to have agreed with PwD on the formulation of the questions in the questionnaire.

Finally, with respect to the focus group, the degree of acceptance of the tool was important. In addition, the contributions of the PwD on the improvements to be made were very interesting and will be included as future work.

6   Conclusions

The AQ is an accessible tool that allows PwD to evaluate website accessibility and share comments, either publicly or with institutional contacts if available. It helps collect and channel complaints to developers, media, or legal entities, addressing the lack of both accessibility and formal complaint mechanisms.

This article presented a comprehensive evaluation of the AQ tool using various UCD methods, combining automatic and manual technical tests with the participation of PwD through usability testing, surveys, and focus groups. It also highlighted the need to adapt evaluation methods—such as simplifying usability questionnaires—to ensure accessibility for PwD.

This comprehensive accessibility evaluation process was developed by experts and end users, and follows an extensive and in-depth approach which is aligned with the seriousness of the case. A set of highly valuable opinions, suggestions and findings were obtained from the PwD who participated in the evaluation process, which will be very useful to be considered in future work.

The evaluation, conducted by experts and PwD, yielded valuable insights to guide future improvements. Planned updates include educational content, complaint tracking, editing features, opinion filters, and a support website with tutorials, a glossary, and accessibility rights information.

This initiative seeks to empower PwD and promote digital accessibility through inclusive tools like the AQ. Accessibility must be addressed broadly—not only in websites but also in evaluation methods—to ensure full, autonomous participation and foster a more inclusive digital environment for everyone.

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