

# Accessibility and readability of university websites in Finland

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**Abstract.** This article describes a study conducted by the authors to evaluate the accessibility and readability of the contents of the Web sites of seven universities in Finland. The accessibility assessment has been carried out to check compliance with accessibility guidelines for Web content established by the World Wide Web Consortium recommendation in WCAG 2.0. The readability has been evaluated using the Flesch Reading Ease Level formula for English texts. We have tried to determine whether the universities have been concerned to provide accessible information about the university through its website so that it can be accessed by everyone (teachers, students), regardless of whether or not the user has a disability.

**Keywords:** Web content accessibility, readability, usability, ranking of universities, disability, WCAG 2.0.

## 1 Introduction

Accessibility indicates how easy is to use, visit or access something, in general, for all people, especially those who have disabilities. Web accessibility is referred to design allowing these people to perceive, understand, navigate and interact with the Web.

Among standardization efforts, we remark the Web Accessibility Initiative of World Wide Web Consortium (W3C) which tries to establish recommendations for achieving accessible contents, browsers and Web development environments. Among their recommendations the Web Content Accessibility Guidelines (WCAG), or set of guidelines for accessible Web pages, are specially important. The last version of this recommendation is WCAG 2.0 [1,2]. The study carried out in this article is based precisely on this latest version, which provides twelve guidelines to follow. These twelve guidelines cannot be directly tested as they provide the basic criteria that authors should fulfil in order to make content more accessible for people with disabilities. For each guideline, it provides testable success criteria that allow guidelines to be used in situations where appear certain requirements and the need for conformance testing [1].

In this paper, we have analyzed a group of Web pages of the websites of seven universities of Finland, checking the degree of compliance with WCAG 2.0 recommendations. Firstly, in the following section, we justify the choice of universities to

be evaluated. In section 3 we describe the accessibility indicators to be evaluated and the calculated metric that will rank universities according to compliance with the established success criteria in WCAG 2.0. In section 4 we discuss the results of the analysis while the last section is dedicated to the results of readability analysis applied to the text in the page in English dedicated to the history of each university.

## 2 Selection of websites of universities

The main goal of this work is to contribute to the project ESVAL funded by the EU Alfa program. It includes, as members, the two universities involved in this project (University of Alcalá and Metropolia University). One of the initial tasks in this project is an accessibility review of higher education institutions of the countries of the partner universities. This is the reason why the study includes the Metropolia University as a partner of the project ESVAL while it has been increased to embrace other universities of Finland. We have chosen the six shown in the latest version (Data from 2010) in the “Academic Ranking of World Universities” (ARWU) available at <http://www.arwu.org>. We chose this ranking as one of the most known and consistent.

The study includes the analysis of three of the webpages of each of the seven selected universities. The first one is the main page (Home), the second is a page with forms and the third one is a page with tables. The table 1 shows the universities and the pages finally analysed.

University	Web pages
University of Turku	Home: <a href="http://www.utu.fi/en/">www.utu.fi/en/</a> Form: <a href="http://www.utu.fi/en/feedback.html">www.utu.fi/en/feedback.html</a> Data table: <a href="http://www.utu.fi/en/studying/programmes/masters.html">www.utu.fi/en/studying/programmes/masters.html</a>
Aalto University	Home: <a href="http://www.aalto.fi/en/">www.aalto.fi/en/</a> Form: <a href="http://eage.aalto.fi/?registration/register&amp;lang=en">eage.aalto.fi/?registration/register&amp;lang=en</a> Data table: <a href="http://www.aalto.fi/en/cooperation/career_services/talentit_en/stands/">www.aalto.fi/en/cooperation/career_services/talentit_en/stands/</a>
University of Jyväskylä	Home: <a href="http://www.jyu.fi/en">www.jyu.fi/en</a> Form: <a href="http://www.jyu.fi/en/study/study_frontpage/contact-info">www.jyu.fi/en/study/study_frontpage/contact-info</a> Data table: <a href="http://www.jyu.fi/en/contacts/">www.jyu.fi/en/contacts/</a>
Helsinki Metropolia University Applied Sciences	Home: <a href="http://www.metropolia.fi/en/">www.metropolia.fi/en/</a> Form: <a href="http://www.metropolia.fi/en/feedback/">www.metropolia.fi/en/feedback/</a> Data table: <a href="http://www.metropolia.fi/en/apply/how-to-apply/bachelors-degree-evening-studies/timetable-summary/">www.metropolia.fi/en/apply/how-to-apply/bachelors-degree-evening-studies/timetable-summary/</a>
University of Eastern Finland	Home: <a href="http://www.uef.fi/uef/english">www.uef.fi/uef/english</a> Form: <a href="http://www.uef.fi/palaute">www.uef.fi/palaute</a> Data table: <a href="http://www.uef.fi/tutustu">www.uef.fi/tutustu</a>
University of Helsinki	Home: <a href="http://www.helsinki.fi/university/">www.helsinki.fi/university/</a> Form: <a href="http://www.helsinki.fi/funds/feedback.htm">www.helsinki.fi/funds/feedback.htm</a> Data table: <a href="http://ethesis.helsinki.fi/julkaisut/kas/kasva/vk/karkkainen/6luku.html">ethesis.helsinki.fi/julkaisut/kas/kasva/vk/karkkainen/6luku.html</a> - table1
University of Oulu	Home: <a href="http://www.oulu.fi/english/">www.oulu.fi/english/</a> Form: <a href="http://www.oulu.fi/english/contact">www.oulu.fi/english/contact</a> Data table: <a href="http://www.degree.oulu.fi/admission/language-requirements/">www.degree.oulu.fi/admission/language-requirements/</a>

**Table 1.** URL of the analysed web pages.

## 3 Accessibility: evaluated criteria

This work examines the main accessibility barriers identified in an analysis of a sam -

ple of Finnish university web sites in relation to the currently applicable W3C/WAI Web Content Accessibility Guidelines 2.0 (WCAG 2.0). The technical accessibility analysis takes into account a set of accessibility criteria based on W3C guidelines.

For the evaluation of each of the pages of the sample, we took as reference the standard WCAG of Accessibility of Web content in the Web 2.0 of the W3C [1], synthesized in a series of technical checks on those aspects which are most relevant and with highest incidence. Based on the study done by the INTECO [3], this verifications are put into one set of fourteen indicators referred to the recommendations of WCAG.

These indicators have been selected because they reflect most of the guidelines of WCAG 2.0 for the three possible levels (A, AA y AAA). A series of checks to analyse different aspects of each indicator are the key elements used for each indicator. These criteria are commonly accepted as providers of an accurate overview of the accessibility of a website.

The indicators considered for the analysis are shown below:

1. **Valid Web documents:** Checks if the pages are compliant with the grammars of HTML and CSS (used tools: W3C validator of HTML and CSS <http://validator.w3.org/>).
2. **Images:** Checks if there is an alternative text for images or images maps as well as that images are not used to transmit textual information (used tools: manual review and TAW validator <http://www.tawdis.net/>).
3. **Headers:** There should be a header structure that adequately reflects the logical structure of documents to facilitate reading, understanding and non-visual navigation (used tools: manual review and TAW validator).
4. **Links:** check possible links without content, links with the same text and destinations, or links that open in new windows without a warning (used tools: manual review and TAW validator).
5. **Contrast and semantic use of colour:** check whether the colour contrast between foreground and background colour is enough and if the colour is not used as the only visual way of conveying information (used tools: Colour checker – extension for Mozilla Firefox).
6. **Presentation:** check if the page uses HTML tables for layout and other requirements related to the visual presentation of text (used tools: manual review and TAW validator).
7. **Text size:** text must be defined in relative units to allow the resizing for readability, adapting to the needs of people who is accessing it (used tools: manual review and TAW validator).
8. **Forms:** Form elements for entering data must be used properly to allow proper interaction with assistive technologies and users (used tools: manual review and TAW validator).
9. **Data tables:** They must be used properly to identify tabular data and related information (used tools: manual review and TAW validator).
10. **Accessibility via keyboard:** The components of user interface and navigation must be operable, so it is necessary to have all the functionality of the

page available through the keyboard (used tools: manual review and TAW validator).

11. **Attacks:** Aimed at evaluating access to the site without causing problems of photosensitivity-caused attacks (used tools: manual review and TAW validator).
12. **Navigable:** Web sites should help users to browse and access pages (used tools: manual review and TAW validator).
13. **Understandable:** Aimed at identifying the use of correct language as well as language changes in the document which facilitate understanding of users who use screen readers or speech synthesis programs (used tools: manual review and TAW validator).
14. **Enough time:** Provide users enough time to read and use contents (used tools: manual review and TAW validator).

Based on the study made by the INTECO [3], the verification are evaluated based on the values “Hits“, “Failures“, “Few Failures” y “Not Applicable (NA)”:

- Hits: Met the requirements for verification.
- Failures: Do not met the requirements for verification.
- Few Failures: Exceptional circumstances applicable to checks where the failure is minimal. This situation is valued as half a point.
- Not applicable: Non availability of minimum number or conditions of items for evaluation.

The total number of evaluated indicators is the following one:

$$Total\_of\_indicators = N^{\circ}\_indicators\_evaluated \cdot N^{\circ}\_pages\_evaluated$$

Being the number of evaluated indicators equal to 14 (the indicators described in this section) and evaluated numbers of pages equal to 3. Therefore, the maximum number of indicators taken into account in the evaluation is 42.

From this number it is necessary to eliminate the indicators not applicable (NA). For each of the pages, this number will take a different value. Once you have found the previous data, the success rate of the page is calculated as follows.

$$Success\_rate = \frac{100\% \cdot Hits + 50\% \cdot Few\_Failures}{Total\_applicable\_indicators}$$

\*Being Hots the indicator that meet the requirements of the success criteria of WCAG 2.0, few failures of the minimal failures, and total\_applicable\_indicators the value calculated above (42 - NA). In the case of the total number of indicators are fulfilled, then the success rate of the page would be 100%.

## 4 Results

Table 2 summarizes the results obtained in the analysis of accessibility for the sample of 7 university portals in terms of percentage of covered or not covered indicators, those with few errors, not applicable and success rate (ranked from highest to lowest level).

University	Hits	Failures	Few failures	NA	Success rate
1. University of Turku	22	12	1	7	62.85%
2. Aalto University	19	12	4	7	54.28%
3. University of Jyväskylä	18	17	0	7	51.48%
4. Helsinki Metropolia	17	18	0	7	48.57%
5. University of Eastern Finland	16	19	0	7	45.71%
6. University of Helsinki	13	19	2	8	38.23%
7. University of Oulu	13	22	0	7	37.14%

**Table 2.** Results of the analysis made on the portals.

The principal problems founded are:

1. **University of Turku:** During the validation of documents, there aren't any websites that validate HTML or CSS grammar. In the case of presentation, one of the websites contain common errors such as not fulfilling the required minimum spacing as well as having text blocks that contain more than 80 characters. Even more, there are static sizes in the text in every page. The selected website with forms contains errors because it has not labels in its elements. When analyzing the accessibility of keyboard, the user cannot access all the elements with the keyboard in all of the websites. All websites contains problems of navigation as they have many items that do not have focus option for keyboard and mouse.
2. **Aalto University:** During the validation of documents, none of the websites properly validates its HTML code because they contain a large number of errors. Only the CSS code of one website is valid. One of the websites presents errors in the headers because it contains two at the same level and not well structured. Regarding the contrast and the semantic use of color, the pages have many links that change color merely when the user passes over them. The selected website with forms contains errors because it has not labels in its elements and does not show enough support for the user. All websites contains problems of navigation as they have many items that do not have focus option for keyboard and mouse.
3. **University of Jyväskylä:** During the validation of documents, there aren't any websites that validate HTML. Two of the websites have errors in the images because they do not contain alternate text. One of the websites presents errors in the headers because it does not contain the header h1. In terms of presentation, all pages containing the mistake of using tables for layout information from the page without being data. The selected website with forms contains errors because it has not labels in its elements and does not show enough support for the user. There are errors on data tables because there is not an abstract of the table and there are not headers in the columns. When analyzing the accessibility of keyboard, the user cannot access to all the ele-

ments with the keyboard in all of the websites. All websites contains problems of navigation as they have many items that do not have focus option for keyboard and mouse.

4. **Helsinki Metropolia:** During the validation of documents, two websites properly validate its HTML and CSS code, the other website do not validate because it contains five errors. We consider this as a minor error. All of the websites have errors in the images, because they do not contain alternate text; we consider this as a minor error. Two of the websites presents errors in the headers because they have repeated headers of the same level. Regarding the contrast and the semantic use of color, there are two pages containing a good number of contrast errors in their texts, images and links. In the case of presentation, all pages have errors because they use style attributes within the HTML code. There are static sizes in the text of all websites. The selected website with forms contains errors because it has no labels in its elements. When analyzing the accessibility of keyboard, the user cannot access to all the elements with the keyboard in all of the websites. All websites contains problems of navigation as they have many items that do not have focus option for keyboard and mouse.
5. **University of Eastern Finland:** During the validation of documents, there are not any websites that validate HTML code. Two of the websites have errors in the images because they do not contain alternate text. Regarding the contrast and the semantic use, we have found out several errors in some of the texts of every page, moreover, there are links that are identified only by passing over them. In the case of presentation, all pages have errors. In one of them, a table is used for layout information. There is static size in the text of every page. Besides that all pages use style attributes within the HTML. The selected website with forms contains errors because it has not labels in its elements. There are errors in data tables: there is not an abstract of the table. When analyzing the accessibility of keyboard, the user cannot access to all the elements with the keyboard in all of the websites. All websites contains problems of navigation as they have many items that do not have focus option for keyboard and mouse.
6. **University of Helsinki:** During the validation of documents, only one website properly validates its HTML code, the others websites do not validate because they contain a large number of errors. In the case of CSS code, all of the websites are correct. All of the websites have errors in the images because they do not contain alternate text and they can be replaced by mark-up. One of the websites presents errors in the headers because it contains headers at the same level and they are not well structured. In the case of presentation, no websites are fulfilling the required minimum spacing and one of the websites has attributes of presentation in its HTML document instead in the CSS document. Even more, a website uses absolute units. The selected website with forms contains errors because it has not labels in its elements and does not shows enough support for the user. There are errors in data tables, e.g. there is not an abstract of the table. When analyzing the accessibility of keyboard, the user cannot easily access all the elements of two websites with the keyboard. Two of the websites have errors of navigation referred to location and focus. None of the websites has declared the language of the document in the page.
7. **University of Oulu:** During the validation of documents, no websites validate HTML code. Two of the websites have errors in the images because

they do not contain alternate text. One of the websites presents errors in the headers because it does not contain the header h1 and has repeated headers of the same level. All of the websites have errors in the links because contain consecutive links of image and text send the user to the same resource. Regarding the contrast and the semantic use of color, there are two pages containing many contrast errors in their texts, images and links. In the case of presentation, all websites contain common errors such as not respecting the required minimum spacing and including text blocks that contain more than 80 characters. Even more, there is static size declaration in the text of every page. The selected website with forms contains errors, because it has not labels in its elements. When analyzing the accessibility of keyboard, the user cannot access to all the elements with the keyboard in all of the websites. All websites contains problems of navigation as they have many items that do not have focus option for keyboard and mouse.

#### 4 Evaluation of readability of web pages

Readability is the ease in which text can be read and understood. As an additional part of the research, we have done an assessment of the readability of textual contents of web portals of the seven selected universities using the well-know Flesch Reading Ease Level formula (RES) for English texts [4]:

$$RES = 206.835 - 1,015 \cdot \left( \frac{total\_words}{total\_sentences} \right) - 84,6 \cdot \left( \frac{total\_syllables}{total\_words} \right)$$

We have analyzed the readability of the web pages which present the history of each universities, using a free software (<http://flesh.sourceforge.net>). The results are shown in table 3.

University	Accessibility position	Flesch Reading Ease Level	Level of readability
1. University of Jyväskylä	3	46.8	Hard
2. University of Helsinki	6	42.91	Hard
3. University of Turku	1	37.58	Hard
4. University of Eastern Finland	5	29.72	Very Hard
5. Aalto University	2	27.27	Very Hard
6. University of Oulu	7	26.85	Very Hard
7. Helsinki Metropolia	4	11.27	Very Hard

Table 3. Results of readability analysis

#### 4 Conclusions

Accessibility of universities in Finland is not bad compared with the results of other similar universities in other countries (analysed by the authors in previous studies not yet published) as it is shown by above results. Three of the universities which were analysed (43%) exceed acceptable accessibility barrier, but two (28.5%) are very

close to the barrier. Only two universities (25.8%) are out of the acceptable accessibility level. Regarding readability evaluation of the selected seven sites under analysis, three of them have show a «Hard» level of readability while the other four are in the «Very Hard» level. Note that the University of Turku has the best results in both categories, accessibility and in readability. This usually means that the organization has devoted special efforts to the goal of offering good accessibility to users.

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