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**Please cite the original version:** Lahti, J. (2023) Accessibility Status of E-Commerce Sites of Finnish Universities of Applied Sciences, EDULEARN23 Proceedings, pp. 1828-1833.

doi: 10.21125/edulearn.2023.0555

# ACCESSIBILITY STATUS OF E-COMMERCE SITES OF FINNISH UNIVERSITIES OF APPLIED SCIENCES

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## Abstract

Accessible design of web services is necessary for people with disabilities to access online services. The European accessibility act (EU directive 2019/882) covers products and services that have been identified as being most important for persons with disabilities, including e-commerce. By enshrining the principles of WCAG in the Web Accessibility Directive, the European Union is officially requiring its member states to abide by WCAG 2.1 Level AA standards. These standards set accessibility requirements also for all educational institutions offering e-commerce services around the EU.

The importance of accessibility is even more significant in education system to provide equal opportunities for everyone in a world digitalizing rapidly. The Finnish higher education system contains 14 Universities and 24 Universities of Applied Sciences. While the mission of the Universities is to conduct scientific research and provide education based on it, Universities of Applied Sciences offer more practical education that aims to respond to the needs of the labour market. The aim of this study is to evaluate the current accessibility status of all available e-commerce sites of the Finnish Universities of Applied Sciences.

In this study 15 e-commerce sites owned by Finnish Universities of Applied Sciences were evaluated against the WCAG 2.1 Accessibility Guidelines. Accessibility evaluations were done by using two different automatic evaluation tools: Wave and Axe DevTools Pro. Manual evaluation of selected use cases was done with a laptop computer by using NVDA and JAWS screen readers and keyboard. Mobile accessibility evaluation of the same use cases was done by using Android and IOS smartphones with their native screen readers.

Although severe accessibility issues were found, and none of the tested services fully met the critical accessibility requirements, the findings in this study can be used to help to develop accessibility on the tested sites. The sites that had paid more attention to accessible design and offered more accurate accessibility statements can serve as better examples for others in developing more accessible online services in the future.

Keywords: Inclusive Design, Universal Design, Web accessibility, Accessibility compliance, WCAG guidelines.

## 1 INTRODUCTION

*Accessibility means that “people with disabilities have access, on an equal basis with others, to the physical environment, transportation, information and communication technologies and systems (ICT) and other facilities and services”* [3]. To improve accessibility in higher education in Finland, the Ministry of Education and Culture presented a plan of 38 objectives for promoting accessibility, inclusion and diversity in 2021 [8]. Several of these objectives are directly connected to the content of this study.

The main aim of this study was to find out *how well accessibility is taken into account in the e-commerce sites of Finnish Universities of Applied Sciences?*

The motivation to do this research came from the fact that my home organization, Laurea University of Applied Sciences, is currently developing a new online store which also must meet EU-level accessibility standards. The state of accessibility of the websites of Universities of Applied Sciences and universities has been studied before [2,9], but e-commerce has been outside the scope of those studies. In part, this is due to the fact that Universities of Applied Sciences selling educational services online is a relatively new phenomenon. Today, educational organizations and research activities need more and more commercial funding. One way to apply for this necessary funding is to sell educational services and content online.

## 2 METHODOLOGY

Accessibility audits were based on the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0. [13] of the W3C organisation. W3C (The World Wide Web Consortium) is the main international standards organization for the World Wide Web and offers resources accessibility evaluations [12].

Evaluating the extent to which a website conforms to the Web Content Accessibility Guidelines WCAG 2.1 is a process involving several steps described in Figure 1. In this study, technical evaluations of the UAS e-commerce sites with two different automated accessibility evaluation tools Axe DevTools Pro and Wave were limited to:

- The Front page of the e-commerce site
- One example of a product page per site
- The Shopping basket (including order form, excluding actual payment)

It is a commonly known fact that the technical tools do not find all accessibility problems and human testing is also needed for best results [1,7,10,11].

Since effective evaluation of Web accessibility requires more than running a technical evaluation tool, a human tester using assistive technologies with a laptop computer and smartphones tested several use cases:

- 1 Browsing the front page
- 2 Selecting a product
- 3 Filling in the order form (if available)

These essential use cases were tested with a JAWS screen reader and a keyboard on a Windows 10 computer using the latest version of the Chrome browser. Mobile testing was done with smartphones by using their native screen readers TalkBack (Android) and VoiceOver (IOS) plus the latest Chrome (Android) and Safari (IOS) browsers.

The WCAG conformance level was set to AA, based on both the Finnish and EU legislations [4,5,6].

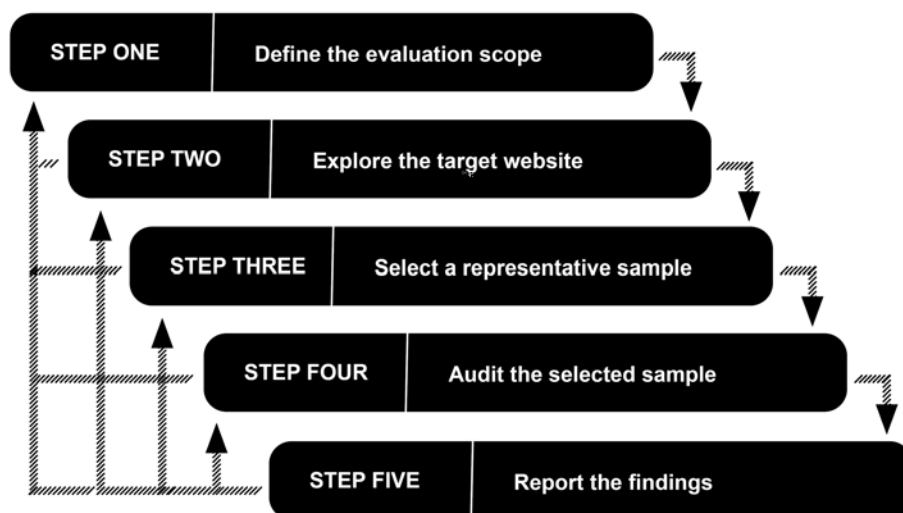


Figure 1. WCAG-EM – Evaluation steps [13].

In the study, 15 existing online stores of different Universities of Applied Sciences were audited in February-March 2023. 9 of the total number of 24 Universities of Applied Sciences in Finland did not have e-commerce sites available at the time and were thus excluded from the study.

Table 1. UAS e-commerce sites in Finland

UAS	URL
Åland UAS	<i>Not tested</i>
Arcada UAS	<a href="https://go.innoflame.fi/goshop/arcadashop/fi/">https://go.innoflame.fi/goshop/arcadashop/fi/</a>
Novia UAS	<i>Not tested</i>
Centria UAS	<i>Not tested</i>
Diaconia UAS	<a href="https://hakija.diak.fi/">https://hakija.diak.fi/</a>
Haaga-Helia UAS	<a href="https://www.haaga-helia.fi/fi/yritysvalmennukset-koulutuspalvelut-ja-kurssit-yrityksille">https://www.haaga-helia.fi/fi/yritysvalmennukset-koulutuspalvelut-ja-kurssit-yrityksille</a>
Humak UAS	<a href="https://kauppa.humak.fi/">https://kauppa.humak.fi/</a>
Häme UAS	<a href="https://shop.hamk.fi/?lang=fi">https://shop.hamk.fi/?lang=fi</a>
JAMK UAS	<a href="https://go.innoflame.fi/goshop/jamk/fi/">https://go.innoflame.fi/goshop/jamk/fi/</a>
XAMK UAS	<a href="https://www.xamk.fi/koulutus/avoin-amk/">https://www.xamk.fi/koulutus/avoin-amk/</a>
Kajaani UAS	<a href="https://shop.kamk.fi/">https://shop.kamk.fi/</a>
Karelia UAS	<a href="https://shop.karelia.fi/">https://shop.karelia.fi/</a>
LAB UAS	<i>Not tested</i>
Lapland UAS	<i>Not tested</i>
Laurea UAS	<i>Not tested</i>
Metropolia UAS	<a href="https://www.metropolia.fi/fi/verkkokauppa">https://www.metropolia.fi/fi/verkkokauppa</a>
Oulu UAS	<i>Not tested</i>
Police University College (UAS)	<i>Not tested</i>
Satakunta UAS	<i>Not tested</i>
Savonia UAS	<a href="https://studystore.savonia.fi">https://studystore.savonia.fi</a>
Seinäjoki UAS	<a href="https://shop.seamk.fi/">https://shop.seamk.fi/</a>
Tampere UAS	<a href="https://www.tuni.fi/fi/palvelut-ja-yhteistyö/tunishop-verkkokauppa">https://www.tuni.fi/fi/palvelut-ja-yhteistyö/tunishop-verkkokauppa</a>
Turku UAS	<a href="https://turkuamk.omapumu.com/fi">https://turkuamk.omapumu.com/fi</a>
Vaasa UAS	<a href="https://www.vamk.fi/hakijalle/jatkuva-oppiminen/avoin/">https://www.vamk.fi/hakijalle/jatkuva-oppiminen/avoin/</a>

### 3 RESULTS

The results include the number of critical and serious accessibility problems found using different evaluation methods. Critical accessibility problems refer to problems that can prevent the use of the service completely for at least some user groups, serious accessibility problems refer to problems that can have a major impact on the use [14].

The number of critical and severe accessibility issues are presented in Table 2. The classification of the violated WCAG 2.1 criteria with the frequency is presented in Table 3.

#### 3.1 Number of accessibility issues found

In the technical analysis and the human testing using assistive technology several accessibility problems were found in each of the tested sites. The technical analysis with Wave and Axe DevTools Pro browser extensions mainly found the same type of accessibility issues, although the number varied by tool. In addition, some new problems were found by the human tester using assistive technology.

In Table 2, the issues found in the technical analysis are listed by the total number found with each tool. In the results of the human tester using assistive technology, unique problem types are only listed once, which explains the slight difference in numbers. Also, it is important to note that sometimes technical accessibility issues do not prevent successful use of assistive technology.

Table 2. Critical and serious accessibility issues found

UAS	Technical analysis		Human tester using assistive technology	
	Wave (all issues)	Axe DevTools Pro (all issues)	NVDA/JAWS+ keyboard (unique issues)	Talkback/ Voiceover+ Smartphone (unique issues)
Arcada UAS	10	11	2	7
Diaconia UAS	35	16	8	6
Haaga-Helia UAS	80	83	3	5
Humak UAS	31	90	6	8
Häme UAS	2	2	1	6
JAMK UAS	3	16	1	8
XAMK UAS	73	27	4	6
Kajaani UAS	2	2	1	7
Karelia UAS	18	4	2	7
Metropolia UAS	12	16	3	7
Savonia UAS	6	1	2	7
Seinäjäki UAS	3	1	2	6
Tampere UAS	44	24	4	6
Turku UAS	34	23	3	7

### 3.2 Classification of accessibility issues

Accessibility problems were classified according to the WCAG 2.1 criteria [14].

The most typical accessibility problems were related to:

- Lack of alternative texts
- Contrast problems
- Keyboard usage
- Lack of visual focus
- Missing language definitions
- Deficiencies in forms
- Error messages
- ARIA coding

These most typical accessibility issues occurred in more than 60% of the tested sites.

Table 3. Frequency of WCAG 2.1 A and AA level criteria violations in UAS e-commerce sites

WCAG 2.1 Criteria	Frequency (in individual site) n=15
<b>Perceivable</b>	
1.1.1 Non-text Content	15
1.2.1 Audio-only and Video-only (Prerecorded)	1
1.3.1 Info and Relationships	3
1.4.3 Contrast (Minimum)	13
<b>Operable</b>	
2.1.1 Keyboard	10
2.1.2 No Keyboard Trap	2
2.4.3 Focus Order	5
2.4.6 Headings and Labels	6
2.4.7 Focus Visible	10

<b>Understandable</b>	
3.1.1 Language of Page	10
3.1.2 Language of Parts	11
3.2.3 Consistent Navigation	4
3.3.1 Error Identification	9
3.3.2 Labels or Instructions	12
<b>Robust</b>	
4.1.1 Parsing	4
4.1.2 Name, Role, Value	10
4.1.3 Status Messages	2

## 4 CONCLUSIONS

This study was limited to a few key pages and use cases of each e-commerce site. With a more comprehensive accessibility audit, the number of problems would be higher. The main conclusion is that more attention should be paid to the accessibility of Universities of Applied Sciences e-commerce sites, to achieve the European Union-wide goals for digital accessibility. A wide range of current European legislations support equal opportunities and rights for all people, and the latest legislations address e-commerce in specific.

The accessibility issues found in this study are partly related to the choices of e-commerce platforms, but a large part of the accessibility issues found were more connected to maintenance and content production. Some examples found are missing alternative texts, contrast problems, missing language definitions, missing mandatory markings of the form fields, error message quality, etc. It is important to pay more attention to the publication process. For example, fast accessibility checks can be easily done with free browser extension tools before publishing new content. Due to the dynamic nature of web pages, accessibility should be continuously monitored and tested with proper accessibility tools. At a higher, administrative level, accessibility should be a key part of the strategy of the Universities of Applied Sciences as the Finnish Ministry of Education and Culture has suggested [8].

In this study, UAS online stores mainly offering other things than educational services, such as UAS branded clothing and other brand material, had significantly fewer accessibility issues. However, these types of online store implementations are not necessarily suitable for selling more complex educational and course products.

E-commerce solutions that are designed to offer complex educational services, should be accessibility audited early in the procurement phase to avoid system-based accessibility issues later. Buying a course from an online store is the first step on a journey in accessible e-learning. The courses and other educational services offered in e-commerce sites are often implemented in e-learning environments. As there are numerous e-learning platforms with their own challenges in terms of accessibility, accessible e-commerce is only the beginning. Universities of Applied Sciences should be front-runners in developing sales of accessible educational services through the whole e-learning journey from start to finish. Accessible e-commerce would be a good start.

## ACKNOWLEDGEMENTS

I would like to thank Sami Kauppinen, Elina Wallasvaara, and Taru Lahti for their valuable comments and help with this article and research. Special thanks to Preeriapingviini Oy for supporting the study offering free use of the technical equipment and application licenses used in accessibility audits.

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