Analysis of the quality of interfaces of selected universities in Lublin

Analiza jakości interfejsów wybranych uczelni wyższych w Lublinie

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Abstract

The analysis of the quality of university websites is of great importance both for the university itself and for candidates for studies or students. A well-designed interface can contribute to the attractiveness of the university in the eyes of potential students as well as facilitate their use by current students and university employees.

The article presents the results of a study of the quality of websites of four universities in Lublin: Lublin University of Technology, John Paul II Catholic University of Lublin, the Higher School of Economics and Innovation and the Higher School of Entrepreneurship and Administration. The study included 32 adult secondary school students, including 16 high school students and 16 technical school students. The research process included four research methods: measurement of task completion time based on a scenario, the SUS questionnaire and the use of the think-aloud protocol and focused interview. The results obtained indicate the strengths and weaknesses of the interfaces of the university websites studied.

Keywords: usability; accessibility; user experience; system usability scale

Streszczenie

Analiza jakości stron uczelni wyższych ma istotne znaczenie zarówno dla samej uczelni, jak i kandydatów na studia, czy też studentów. Dobrze zaprojektowany interfejs może przyczynić się do atrakcyjności uczelni w oczach potencjalnych studentów, jak również ułatwić korzystanie z niego obecnym studentom oraz pracownikom uczelni.

W artykule zaprezentowano wyniki badania jakości stron internetowych czterech lubelskich uczelni wyższych: Politechniki Lubelskiej, Katolickiego Uniwersytetu Lubelskiego Jana Pawła II, Wyższej Szkoły Ekonomii i Innowacji oraz Wyższej Szkoły Przedsiębiorczości i Administracji. Badanie objęło 32 pełnoletnich uczniów szkół średnich, w tym 16 licealistów oraz 16 uczniów technikum. Proces badawczy obejmował cztery metody badawcze: pomiar czasu realizacji zadań na podstawie scenariusza, kwestionariusz SUS, wykorzystanie protokołu głośnego myślenia oraz wywiadu zogniskowanego. Otrzymane wyniki pozwoliły wskazać mocne i słabe strony badanych interfejsów stron uczelni wyższych.

Słowa kluczowe: użyteczność; dostępność; doświadczenie użytkownika; skala użyteczności systemu

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1. Introduction

University web applications are not just a source of information about the university or an interaction tool for registering prospective students, but also a key element in building a positive image of the university itself against competing universities. For this reason, the quality of the website is so important in the age of widespread digitalisation.

A visitor's first impression of a university's website may determine whether he or she decides to explore the educational offer and strengths of that university or to look for another university that presents its positives in a more attractive and transparent way. With these key objectives in mind, the interfaces of university websites should meet a range of requirements and uses, such as aesthetics, responsiveness, functionality and accessibility for people with different needs and impairments, in accordance with inter-national accessibility standards such as WCAG [1] (Web Content Accessibility Guidelines).

Key aspects of website quality include not only easy navigation, but also clear and readable content layout, an attractive visual layer, responsiveness of the site on various mobile devices and user security [2].

Additionally, in the context of educational institutions, the timeliness and accuracy of the information posted is also of particular importance. Applicants are looking for details of study programmes and recruitment procedures, while current students expect easy access to course schedules.

This article aims to comprehensively analyse the quality of selected websites of Polish higher education institutions in Lublin. An attempt was made to assess their usability, accessibility, visual aesthetics, as well as compliance with modern web design standards. This analysis aims not only to indicate the strengths and weaknesses of the studied websites but also to identify best practices that can serve as, a model for other academic institutions. The considerations undertaken in this article take on relevance in the context of contemporary challenges, such as the growing demands of users, the need for digital accessibility for people with disabilities, and the dynamic development of web technologies. At a time when technology is playing an increasingly important role in educational decision-making, investing in the web-site quality becomes not only an image issue, but also a strategic one. The goal is not only to im-prove the user experience, but also to support the university's mission as an educational, scientific and social institution.

2. Literature review

Research on interface quality is crucial for the design of intuitive, accessible, and user-friendly systems. Several approaches and methods for assessing the quality of interfaces can be found in the literature, including testing with software tools or ocular tools, or with an expert or research group. The aim of this literature review is to examine current methods, techniques and tools for analysing interface quality, and to select those that will be best for this topic of article when examining university website interfaces.

Jacob Nielsen, in his article 'Usability Heuristics for User Interface Design' [3], presents 10 usability evaluation heuristics that are still valid today and are the standard for websites in the interface and UX design process. The heuristics, such as clarity, consistency, and fault tolerance, are the foundations for assessing the quality of interfaces. The author of the article emphasises that a key feature of a well-designed interface is its intuitiveness, resulting in an easier understanding of the system's functions without prior knowledge.

According to Mark Milosz in his book Ergonomics of Information Systems, the user interface should be efficient and intuitive, because otherwise it is the cause of many errors and misunderstandings, which ultimately leads to user reliability and frustration. It is therefore important that the interface supports the user's perception of the information. He also points out that the correctness of the interface can have a significant impact on the security of the entire application, which can translate into real threats.

Adepoju and Shehu, in their conference paper [4], discussed the use of tools such as W3C validators to assess accessibility and compliance with WCAG guidelines. Additionally, they applied these tools in a study of academic websites that aimed at improving website usability.

Automated assessment tools allow accessibility issues to be identified quickly and efficiently, which is key to ensuring that websites are accessible to all users, regardless of their skills or limitations. There are automatic accessibility assessment tools such as the WAVE Web Accessibility Tool plug-in [5], developed by WebAIM. This tool easily analyses a site for compliance with WCAG guidelines and the identification of potential accessibility issues.

Rubin and Chisnell, in their book 'Handbook of Usability Testing: How to Plan, Design and Conduct Effective Tests' [6]. The authors emphasise that small well-chosen groups can quickly and effectively identify most usability problems. Additionally, they stress the importance of iterative testing, where tests are conducted repeatedly with different user groups as changes are made to the interface.

Another important research technique is the SUS (System Usability Scale) questionnaire. John Brooke, in his work SUS: 'A Quick and Dirty Usability Scale (1996), introduced the SUS, which has become, a standard tool for evaluating the usability of systems [7]. The SUS consists of 10 questions and scores are presented on a scale from 0 to 100, where a score above 68 is interpreted as good. The questionnaire is widely used because of its simplicity and effectiveness in assessing users' subjective effectiveness.

In a study by Bangor, Kortum and Miller (2008), the SUS was shown to be an effective tool for assessing usability in different contexts and for different types of users [8]. This study confirms that SUS can be used for global systems evaluation and is able to provide reliable and reproducible results.

In the article 'Measuring Usability with the System Usability Scale (SUS)' the author emphasises that the questionnaire is not only an easy-to-use tool, but also effective in assessing users' subjective impressions of the interface [9]. This is particularly important in the context of usability studies, where users' subjective impressions can provide valuable information about the quality of the interface.

Another article on the concept of universality is 'Universal design, inclusive design, accessible design, design for all: different concepts-one goal? On the concept of accessibility-historical, methodological and philosophical aspects [10]. There, the authors point to the problem of a lack of uniform standards in user interface design. A lack of consistency in design can lead to interfaces that are less intuitive and more difficult to use, reducing the overall quality of the user experience and, in the worst-case scenario, to legal and regulatory issues. Digital accessibility refers to the design of websites and applications in a way that provides facilities for the widest possible range of users, including people with different disabilities.

The introduction of Directive 2016/2102 of the European Parliament and of the Council (EU) [11] and the Act of 4 April 2019. [12] on the digital accessibility of public entities' websites and mobile applications highlights the importance of creating accessible websites in the public sector. These requirements are detailed in the literature, which provides guidance on meeting WCAG accessibility standards.

The most important publications for ranking universities are the reports of 'Perspektywy' [13], QS World University Ranking [14], and Times Higher Education World University Rankings [15]. Focusing on the reports carried out by the magazine 'Perspektywy' in the evaluation of Polish universities, criteria such as prestige, scientific effectiveness, publications and citations, innovation, and study conditions are considered. Such a ranking makes it possible to compare the interfaces of highly prestigious universities with those ranked lower in the ranking.

In summary, the above literature provides a wealth of information, tools and methods for analysing the quality of interfaces, highlighting the importance of usability heuristics, accessibility standards, intuitiveness in the design process of user interfaces. In addition, survey groups and the SUS questionnaire are the most popular and effective tools for assessing the usability of interfaces. Also, they are widely used in UX research and user interface optimisation.

3. Purpose of the study

The aim of the research is to assess the quality of the interfaces of the websites of higher education institutions in Lublin offering IT education, as well as to identify usability problems and to propose recommendations to improve the user experience.

The study will be divided into six parts:

- Checking the website interface using the WAVE tool to validate websites and web applications for accessibility.
- Preparing the research environment and developing scenarios. The scenarios will include real interactions that a prospective student may encounter.
- Gathering the research group and conducting an initial survey: basic information about the participants, such as age, gender, experience with computers and websites, and choice of future university.
- Execution of scenarios S1-S9 by users/researchers.
- Recording users' actions by measuring the time taken to perform a single scenario and using a think-aloud protocol. Observing the behaviour of respondents and analysing their responses will provide valuable information about interface interaction problems.
- Completion of an evaluation questionnaire according to the System Usability Scale methodology and individual interviews regarding feelings after the experiment.

3.1. Research tools

The WAVE validator will be used during the research to check the interface for accessibility, thus showing whether the website meets the requirements of universal design for people with disabilities. In addition, it shows the areas that will need to be improved to meet the standards of directives and laws and to be as accessible as possible to each user. The plug-in works in popular web browsers such as Chrome and Firefox, and it is also one of the most popular tools for assessing web accessibility.

3.2. Research environment

Table 1 shows the basic parameters of the tested websites. After a test participant was examined, the browser cache and cookies were cleared to ensure the objectivity of the results and to eliminate the impact of the user's previous interactions with the university's website.

Table 1: Research environment specification

Notebook Lenovo Legion Slim 5-14	
Processor	AMD Ryzen 7 7840HS
Operating memory	16 GB DDR5
Display	14,5" 2880x1800 px OLED
Operating system	Windows 11 Home version 23H2
Web browser	Firefox Browser version 131.0.3 64-bit
Software	Voice recorder, timer

3.3. Research group

The survey included 32 adult secondary school students, including 16 high school students and 16 technical school students. The students had equal experience with websites and were related to the field of computer science, through their school profile. Each participant in the study was informed of the form in which the study would be conducted and its purpose. In addition, each respondent signed a consent form to participate in the UX study and obtained permission from school directors to conduct the research with students.

3.4. Research scenario

The respondents were given nine scenarios to complete, the content of which is shown in Table 2. The focus was on tasks addressing functionality, versatility, and accessibility, as well as selecting navigation elements that would be related to the enrolment stage of the university and the beginning of studying at the university.

The scenarios were designed with varying degrees of difficulty to allow the user experience to be assessed and to highlight areas of the website interface that may require improvement, with particular emphasis on the areas of navigation efficiency, readability, responsiveness and compliance with web accessibility standards.

Table 2: Content of tasks used in the UX study

No.	Content of the scenario
1.	Find information about the recruitment process, the required documents, and the application deadline. Indicate this deadline.
2.	Find the detailed programme of study for the first degree full-time course in computer science. Indicate the number of hours.
3.	Find the telephone number, email address, or opening hours of the dean's office. Indicate these items.
4.	Find information about the cost of tuition and additional fees for this course. Indicate the tuition fee amount for one semester.
5.	You are planning to go to study abroad under the Erasmus programme. Find information about travel opportunities and the deadline for enrolment.
6.	You have a visual problem and need increased contrast to use the website comfortably. Find and enable high contrast on the page (black-and-yellow colour scheme)
7.	You are a foreigner and want to browse the site in English'. Find the option to change the language and switch the page to English.
8.	You want to borrow the book 'Algorithms: data structures and programming techniques' by Piotr Wroblewski published by Helios in 2003. Use the library catalogue search engine on the university website and find this item in the catalogue.
9.	You want to use the Office 365 service that the university offers to students. Find information on the website about how to access Office 365 and how to log in.

3.5. Comparative metrics

The study produced the following data:
- Average execution time for each scenario - allows us to determine how long on average it takes a user to search for a particular element on the website.
- SUS questionnaire score – allows the usability of the website to be determined.
- Recordings - to determine which elements users liked and disliked, as well as the difficulties they encountered while performing the tasks.
- The number of errors and warnings in the accessibility evaluation of the university's website content.

The SUS score was calculated using the formula:

$$\text{SUS} = \left(\sum_{i=1,3,5,7,9} (S_i - 1) + \sum_{i=2,4,6,8,10} (5 - S_i) \right) \times 2.5 \quad (1)$$

where i represent the number of the question in the survey, and S_i is the evaluation of question i by the participant.

4. Results

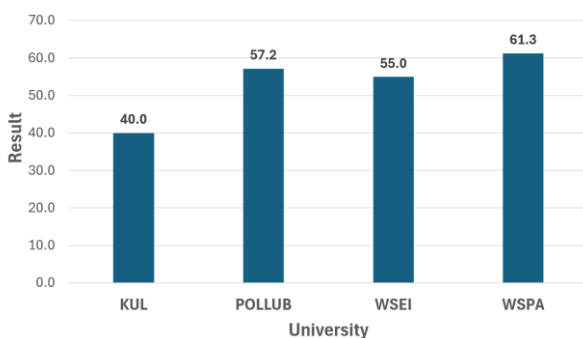The average score of the SUS questionnaire for each university is shown in Figure 1.

Figure 1: Average score of the SUS questionnaire for a given university.

In addition, Table 3 shows the average time to complete a particular scenario for each university.

Table 3: Average scenario time for each university

Scenario	KUL[s]	Pollub[s]	WSEI[s]	WSPA[s]
S1	322	134	268	86
S2	83	160	80	113
S3	48	157	155	21
S4	196	350	48	97
S5	52	277	77	190
S6	8	16	35	49
S7	1	13	4	3
S8	149	140	77	151
S9	lack	48	46	28

Figure 2 presents the execution time distribution for the scenarios.
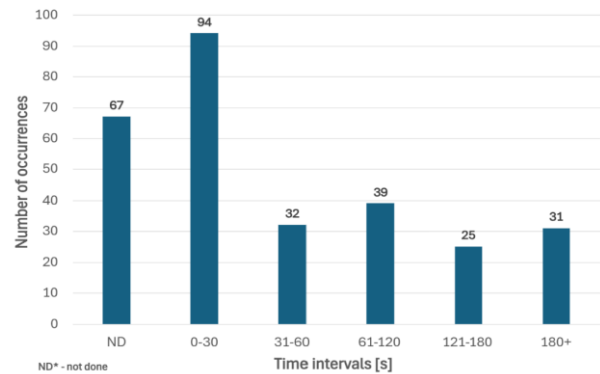

Figure 2: Execution Total time Distribution for Scenarios.

Table 4 shows the number of errors, the number of contrast errors, and warnings for each university website because of scanning with the WAVE plug-in. The table includes errors, contrast errors, and warnings. Other elements are not included because they do not indicate direct accessibility problems.

Table 4: Number of errors and page availability alerts detected by the WAVE plugin

University	Number of errors	Number of contrast errors	Number of alerts
KUL	16	41	191
Pollub	15	4	35
WSEI	3	24	268
WSPA	25	53	170

5. Discussion

The analysis of the results of the SUS questionnaire and the average times of the scenarios revealed significant differences in the usability quality of the websites of the surveyed universities. Figure 1 shows the average SUS score, indicates a similar level for the three Lublin universities in terms of user satisfaction with the operation of the researched websites. The respondents indicated that KUL University stands out in terms of interface usability. This is indicated by the average score of the SUS questionnaire, the average times for performing the scenarios (no one managed to perform scenario S9) and the general opinion after the interview.

The results suggest that the websites of the different universities have a similar degree of usability and intuitiveness apart from the university of KUL, however, no university achieved an SUS score above 68, which can be interpreted as an average score. Variables such as:
- Lack of experience with this type of website.
- Taking too long to solve some of the tasks in the task questionnaire.
- Too complicated navigation.

On the other hand, Table 3 illustrates the variation in navigation efficiency and information accessibility based on average scenario completion times. There are clear discrepancies between the sites, both for simple scenarios (e.g., S7 - finding basic information quickly) and for more complex (e.g. Scenarios: S2, S8 - completing

a more advanced task such as finding detailed academic information).

The scoring list shows:

- WSEI is characterised by a relatively long time to complete the scenario on finding the recruitment date and contacting the dean's office of the Faculty of Information Technology (Scenario S1 - 268 s and Scenario S3 - 155 s), which may indicate difficulties in finding information or a less intuitive website structure Scenarios related to finding university fees and using the library catalogue took much less time compared to other universities, which may indicate simple navigation of the website.

- WSPA achieved the best time results for tasks requiring short navigation (e.g. Scenario S3 - 21 s, Scenario S7 - 3 s), but had problems using the library catalogue and finding this element on the website (e.g. S8 - 151 s). This indicates poorly designed navigation, as the navigation bar with this element merges with the bookmarks bar of the web browser, both in terms of font size and colour scheme. The Figure 3 shows the incorrect colour scheme of the website navigation bar and browser bookmark bar (dark mode). For this reason, none of the respondents used the navigation bar to navigate to the university library sub-page.
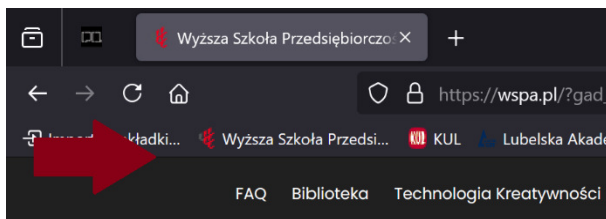

Figure 3: Navigation bar of the WSPA university website (polish version).

- Pollub (Lublin University of Technology) recorded rather long completion times for the scenarios, which may be indicative of uneven quality in different parts of the site, ranging from a good result in Scenarios S6 (16 s), S7 (13 s), S9 (48 s) to considerable difficulty in Scenario S4 (350 s). This kind of time was due to the complexity of navigating to this information, as well as the information being in a PDF file that had too much blank space between pages, which was very confusing for those taking the survey.

- KUL stands out for its short times for simple tasks related to accessibility features and language changes (e.g., Scenario S6 - 8 s, S7 - 1 s), but the long times in Scenario S4 (196 s) and Scenario S8 (149 s) indicate potential problems related to navigation in the more complex sections. Respondents complained about the chaotic layout of content on the site and the unintuitive navigation of the site. In addition, no person was able to find information regarding access to Office 365. This is because the information is very difficult to find, both when using the search engine on the website (the information is located on another department's website instead of being publicly available to potential applicants and students at this university).

Analysing the Figure 2, it can be concluded that the interfaces of the university's websites have intuitive navigation, as the resolution time for most scenarios is between 0 and 30 seconds, as evidenced by 94 occurrences in this range. However, it is concerning that in 67 cases within the study group, the scenario was not solved. This may be due to overly complicated navigation, the research group's lack of experience with this type of website, or a poorly designed interface. It is also worth noting, as shown in Table 3, that the research group studying the KUL website failed to solve scenario 9.

Moreover, it is concerning that in 31 instances, users took more than 3 minutes to complete the scenarios. This may negatively affect engagement with such websites, where information should be easily and quickly accessible to all. The figure 4 shows an example of the accessibility panel on the WSEI website, containing several options for people with visual impairments, emphasizing the crucial importance of accessibility of university website interfaces.
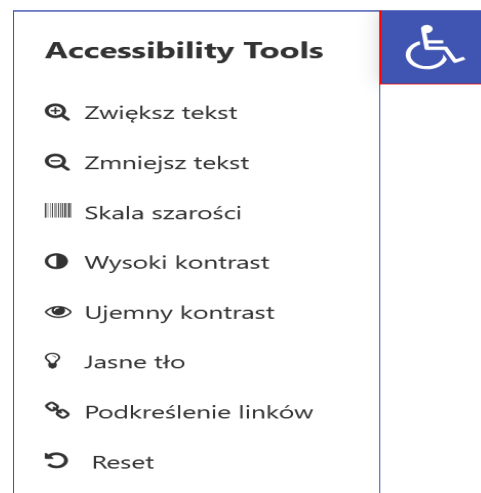

Figure 4: Accessibility panel on the WSEI website (polish version).

This analysis indicates the different strengths and weaknesses of each site, which may be due to different approaches to design and priorities in website implementation.

6. Conclusions

The analysis of the results of the SUS questionnaire and the average execution times of the scenarios showed significant differences in the usability quality of the surveyed university websites. WSPA achieved the highest average SUS questionnaire score, indicating good usability of the system, but did not score above 68. The website scored well in tasks requiring quick navigation, indicating that it is more intuitive and clearer, and do not require the user to try to quickly find information of interest on the website. On the other hand, WSEI and Pollub require significant improvement in more complex scenarios where users had difficulty finding information or completing the tasks set. This is due to the fact that they navigate through several sub-pages of the university, click on links or scroll the page frequently, as the target elements are located in the bottom layout of the page.

The long completion times of some scenarios, especially the more complex ones, clearly indicate the need to simplify navigation and optimise the structure of the information. There is also a need to improve the clarity of the user interface so that using the sites is more intuitive and less time-consuming.

It is recommended that each university conduct a detailed audit of its websites based on the results of its research. On this basis, it is worth investing in optimising problem areas such as content organisation, search engine functionality, or simplifying navigation. It is commendable that each site offers functionality for people with disabilities through buttons to change contrast or font size on the page. The universities also accommodate international students by offering the option to change the website language to English or Ukrainian.

In summary, the results are a valuable indication for universities seeking to improve their digital quality. Investing in a better website structure or more intuitive navigation can not only increase user satisfaction but also increase the competitiveness of the university in the context of a rapidly changing educational market and encourage more potential applicants to study at their university. Most people, both in life and in the use of all kinds of devices, are guided by the principle of 'first good impression'; websites are no exception to this rule.

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