

# Emotional Design, User Experience and Usability on Public Universities' Websites in Mainland Portugal

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Universities' online presence is essential in today's digital age, and the Internet is a fundamental intermediary with universities' various audiences. This study aimed to assess the usability, user experience (UX), and emotional impact of the 11 websites of public universities in mainland Portugal to determine if they met users' expectations. A mixed-methods approach was employed to analyse the usability, user experience and emotional responses of 220 university students who interacted with these websites and subsequently completed an online questionnaire. To the best of our knowledge, this work provides the first comprehensive evaluation of all public university websites in mainland Portugal, establishing a benchmark for their UX quality and identifying opportunities for improvement. The results showed that although most of the websites demonstrated good usability, there were significant gaps. The highest usability ratings were given to the University of Beira Interior, ISCTE – University Institute of Lisbon and the University of Lisbon, while NOVA University Lisbon and the University of Minho had the lowest ratings. User satisfaction requires improvement on all platforms, particularly in navigation, information structure and organisation. UX was considered negative for all universities when compared to industry standards, underlining a discrepancy between user needs and current implementations. Universities requiring urgent UX improvements include the University of Trás-os-Montes e Alto Douro, the University of Minho and NOVA University Lisbon. The 'Novelty' metric received the lowest scores, indicating that users consider these websites non-innovative, with low creativity and limited ability to capture interest. However, the emotions generated were generally positive, especially for the University of Beira Interior, the University of Lisbon and the University of Aveiro. Based on these findings, key recommendations were formulated – for example, simplifying menu structures, improving information architecture, and incorporating more engaging content – in order to optimise usability, user experience and emotional impact on each platform. Implementing these improvements is expected to offer a more effective and positive online experience across all the universities' websites.

**Keywords:** User Experience Design, Emotional Design, Usability, Institutional Websites, Public Higher Education

## 1 Introduction

In today's world, the Internet has become irreplaceable, changing the way people access information, communicate, acquire knowledge and relate to others. As centres of knowledge and academic progress, higher education institutions are heavily influenced by this digital shift. The institutional website often serves as the first touchpoint for students, prospective students and their families, teachers and researchers, enabling interaction with these audiences. Given its communicative relevance, human–computer interaction significantly influences user navigation and overall experiences [Dix *et al.*, 2004]. In this context, user experience (UX), emotional design and usability are fundamental to ensure that university websites are not just repositories of information, but digital platforms that provide meaningful, intuitive and emotionally positive experiences for their users. UX design, as defined by [Nielsen and Norman, 1998], aims to create digital products that fulfil users' needs effectively, efficiently and satisfactorily. Emotional design recognises the role of emotions in human–computer interaction, in order to evoke positive responses and promote a deeper and more memorable connection with the product or service [Norman, 2004]. Usability refers to the extent to which specified users can use a product to achieve specified goals effectively, ef-

ficiently, and with satisfaction within a specified context of use [Lewis and Sauro, 2021].

Studies exploring the emotional design, usability, and user experience of university websites are scarce, especially for Portuguese universities. This gap highlights the critical need to examine these web interfaces. Given the increasing online presence and digital content dissemination by Portuguese public universities, this study aims to analyse the impact of emotional design, user experience design, and usability on their web interfaces in mainland Portugal. No prior study was found on Portuguese universities' websites; thus, our research addresses this gap by evaluating all 11 public university sites and providing data-driven insights to guide their digital improvement efforts.

## 2 Literature Review

The existing literature highlights the importance of emotional design, user experience (UX) and usability in the development of university websites, emphasising the impact of these elements on user satisfaction and engagement. Emotional design aims to create positive and memorable interactions, influencing students' perception of higher education institutions and facilitating access to information [Norman,

2004]. In parallel, UX design incorporates psychological and emotional aspects that directly affect usability and user trust, making navigation more intuitive and efficient [Hassenzahl and Trastinsky, 2006]. On the other hand, usability evaluates how easily users can interact with a website to achieve their goals by examining navigation, layout, and error recovery [Lewis and Sauro, 2021]. Emotions play a pivotal role in HCI beyond these utilitarian aspects. For instance, positive affect can enhance users' intrinsic motivation and engagement [Isen and Reeve, 2005], while negative emotions such as frustration can impede task performance. Norman's framework of three levels of emotional design (visceral, behavioural, reflective) illustrates that a website's visual appeal, interaction flow, and deeper meaning each evoke responses at different cognitive levels, all of which shape the overall UX [Norman, 2004]. Designers must therefore consider emotional outcomes (e.g., feelings of trust, surprise or irritation) as equally important as traditional usability metrics when creating web interfaces.

Recent studies have explored various strategies to optimise UX in university websites. Turumogan *et al.* [2019] examined the application of Kansei Engineering (KE) in website design for higher education institutions in Malaysia, demonstrating that a design focused on users' emotions can significantly enhance satisfaction and visual appeal. The study utilised a questionnaire based on emotional keywords to assess user responses to a website prototype, concluding that a design grounded in KE principles improves users' emotional experience. The relationship between usability and human-centred design (HCD) has also been extensively studied. Hosseini *et al.* [2021] analysed five university websites in Egypt, demonstrating that the application of HCD – by prioritising users' needs – significantly improves the navigation experience and increases satisfaction levels. The findings revealed that visual hierarchy, navigation familiarity, and content relevance are essential factors for an effective institutional website. Another relevant study, conducted by Karani *et al.* [2021], investigated the usability of the website of Gujarat Technological University in India, using a quantitative model based on the WEBUSE scale and structural equation modelling (SEM). The results indicated that content organisation and readability have a substantial impact on student satisfaction, highlighting the need for continuous website updates and well-structured interfaces. A mixed-methods approach to UX evaluation was demonstrated by Noisuwan [2022], who proposed an analytical model combining qualitative and quantitative data. That study integrated observations of user navigation, usability questionnaires, and digital behaviour metrics, providing a comprehensive understanding of students' interactions with university websites and reinforcing the importance of user-centred design to enhance the efficiency and accessibility of institutional websites.

A recent comparative study by Fakrudeen [2025] evaluated the accessibility and usability of 198 university website homepages across six Gulf countries using automated testing tools. The analysis revealed pervasive accessibility issues – notably missing alternative text for images, low colour contrast, and inadequate keyboard navigation – alongside usability problems such as slow page loading and cluttered layouts. Overall adherence to WCAG 2.0 standards was minimal, al-

though these Gulf university sites were not found to have significantly more serious issues than university websites in other regions.

Limited studies have been conducted on the emotional design, usability and user experience of university websites (e.g., Akgül [2021]; Baroudi *et al.* [2020]; Manzoor *et al.* [2019]), and none were found specifically about Portuguese universities' websites. For instance, Akgül [2021] evaluated Turkish university websites and identified numerous accessibility and usability issues, underscoring the need for inclusive, user-centred design improvements in higher education websites. Baroudi *et al.* [2020] audited 30 Jordanian university websites against WCAG 2.0 and complemented the automated checks with a small-scale student usability test. None of the sites achieved full accessibility compliance, and every portal exhibited at least one critical error or warning. During task-based evaluations, students required multiple navigation steps and considerable time to locate routine information (e.g., announcements, library services), generating frustration and highlighting poor information architecture. Additionally, Latin American HCI research has contributed relevant perspectives – for example, Prates *et al.* [2000] introduced a communicability evaluation method to assess how effectively an interface “speaks” to users, highlighting the value of cultural and semantic considerations in UX evaluation. The present study builds on these works by providing a new analysis in the Portuguese context. The literature demonstrates that emotional design, usability and user experience are essential elements for improving interaction with university websites, influencing institutional perception and user satisfaction. It also highlights the importance of accessibility and inclusion: ensuring that digital platforms cater to diverse users (including those with disabilities or other constraints) is crucial for public institutions' websites. The integration of qualitative and quantitative approaches in UX analysis not only helps identify usability issues but also facilitates the development of effective solutions to optimise students' navigation and digital experience.

### 3 Methodology

#### 3.1 Goals and Methodology

The primary goal of this study is to evaluate the implementation of emotional design, UX, and usability in the websites of public higher education institutions in mainland Portugal. Specifically, the research aims to address the following questions:

- RQ1: Do higher education institutions' websites offer good usability?
- RQ2: Do higher education institutions' websites provide a good user experience?
- RQ3: Do higher education institutions' websites tend to induce positive or negative emotions in users?

Based on these questions and prior findings, we formulated the following hypotheses: (H1) There are significant differences in usability and UX metrics among the universities' websites; (H2) qualitative user feedback will reveal common

problem areas across the sites (notably in navigation and information structure); and (H3) websites with higher usability and UX scores will elicit more positive emotions (and fewer negative emotions) from users, compared to lower-scoring sites.

### 3.2 Procedures

Data collection for this study was conducted through online questionnaires made available on the Google Forms platform between 24 October 2023 and 3 August 2024. The questionnaire links were distributed informally via email, social media, and personal contacts to ensure a diverse sample of university students. Each website was evaluated by a group of 20 participants. To avoid introducing familiarity bias or contaminating variables, none of the participants evaluated the website of the university they attended. Participants were instructed to complete a set of predefined tasks on the assigned university website before responding to the questionnaire. Specifically, two realistic usage scenarios were defined to simulate typical user goals. In the first scenario, participants had to locate information about a specific course, including its admission requirements (S1T1) and to find the academic calendar, paying attention to the start dates of classes and holiday periods (S1T2). The second scenario required participants to find information about the Academic Services (S2T1) and about the Social Action services of the university (S2T2). These tasks were designed to reflect common user interactions and to assess how effectively each website supports users in completing such information-seeking activities. Participation was voluntary, and responses were anonymous and confidential, ensuring data integrity.

### 3.3 Study Participants

The sample consisted of 220 university students from public institutions in mainland Portugal, aged between 19 and 31 years. Among them, 112 (50.91%) were male, 106 (48.18%) were female, and 2 (0.91%) preferred not to disclose their gender. Responses were obtained from students at different academic levels: 73 (36,5%) undergraduate students, 114 (57%) master students, and 13 (6,5%) doctoral students.

### 3.4 Data Gathering

Data gathering was conducted exclusively through the developed questionnaire, which included:

- i) a statement of free, informed, and explicit consent;
- ii) sociodemographic data;
- iii) measurement of task completion time;
- iv) the Portuguese version of the USE Questionnaire (Usefulness, Satisfaction, and Ease of Use) (Dantas *et al.* [2017]; Lund [2001]);
- v) the Portuguese version of the UEQ (User Experience Questionnaire [Cota *et al.*, 2014]);
- vi) an assessment of users' emotional responses;
- vii) the PANAS questionnaire (Tran [2013]; Watson *et al.* [1988]);
- viii) open-ended questions.

Established evaluation tools were used for each component under analysis:

- **Task completion time:** The time taken to complete the predefined tasks was recorded (by self-report) and analysed to assess efficiency.
- **USE Questionnaire:** The USE Questionnaire developed by Dantas *et al.* [2017] and Lund [2001] was essential for this assessment. It consists of 30 items evaluating usability across four dimensions: Usefulness, Ease of Use, Learnability, and Satisfaction.
- **UEQ:** The Portuguese version of the UEQ, a validated tool for assessing user experience beyond usability (Cota *et al.* [2014]; Schreier [2012]), was applied. It comprises 26 items across six seven-point Likert scales, covering usability aspects (e.g., clarity, efficiency, and dependability) as well as experience-related elements.
- **PANAS Questionnaire:** Recognised for its significance in emotional research, PANAS (Positive and Negative Affect Schedule) was included to measure users' emotional responses. It assesses both positive affect (e.g., enthusiasm) and negative affect (e.g., fear) (Tran [2013]; Watson *et al.* [1988]). The use of this tool enabled a deeper understanding of both usability and the emotional impact of university websites.
- **Open-Ended Questions:** 1) A question about the positive and negative aspects of websites is essential for improving the user experience and optimising communication. Feedback allows for informed decisions to improve the website and meet the needs of the public. 2) A question about the difficulty of tasks helps to identify problems and make interfaces more accessible. The Qualitative Comparative Analysis methodology, proven to be effective with qualitative questions [Schreier, 2012]. Both questions were analysed using an inductive qualitative content analysis approach adapted from Schreier [2012]. The authors independently performed open coding on the entire set of responses and iteratively developed a coding frame of 11 categories. After initial coding, results were compared and differences were reconciled through discussion; ambiguous responses were jointly examined until consensus was reached. This procedure preserved the individuality of responses while allowing rigorous cross-case comparisons.

### 3.5 Materials

#### 3.5.1 Independent Variables

Independent variables are manipulated to observe their effects on users. In this study, the independent variables were the websites of the 11 Portuguese public universities. The universities evaluated were UTAD, UMinho, UP, UA, UBI, UC, UL, UNL, ISCTE-IUL, UÉ, and UAlg. These universities were selected as they represent all the public universities in mainland Portugal. Each of their websites has a unique structure and content, reflecting the identity and objectives of each institution. Analysing their characteristics and functionalities allows for an understanding of how universities com-

municate their academic offerings, research, and services to the academic community and the general public.

- a) **University of Trás-os-Montes e Alto Douro:** Founded in 1973, UTAD is recognised for excellence in teaching and research. It is particularly notable for its commitment to sustainability and its Botanical Garden, serving as a hub for innovation in Portugal. (Website: <https://www.utad.pt>);
- b) **University of Minho:** Established in 1973, UMinho is ranked among the best Portuguese universities. With campuses in Braga and Guimarães, it focuses on innovation, science, and technology. (Website: <https://www.uminho.pt>);
- c) **University of Porto:** Founded in 1911, it is one of Portugal's most prestigious universities. It offers a wide range of academic programmes and maintains strong connections with both the business sector and research. (Website: <https://www.up.pt>);
- d) **University of Aveiro:** Since its establishment in 1973, UA has been distinguished by its innovation and strong partnerships with businesses. It is internationally recognised for cutting-edge research projects. (Website: <https://www.ua.pt>);
- e) **University of Coimbra:** Established in 1290, it is one of the oldest universities in the world and a UNESCO World Heritage site. It has a significant impact on Portuguese science, culture, and politics. (Website: <https://www.uc.pt>);
- f) **University of Beira Interior:** Founded in 1986, UBI has a strong regional impact and is committed to research. It is a member of the UNITA Consortium and is home to an award-winning textile museum. (Website: <https://www.ubi.pt>);
- g) **University of Lisbon:** The largest university in the country, formed by the merger of two institutions in 2013. It excels in research in biotechnology, nanotechnology, and renewable energies. (Website: <https://www.ulisboa.pt>);
- h) **NOVA University Lisbon:** Established in 1973, NOVA is one of the top young universities in Europe. It stands out in research and innovation, leading both national and international rankings. (Website: <https://www.unl.pt>);
- i) **ISCTE – University Institute of Lisbon:** Specialising in business and social sciences, ISCTE focuses on connecting academia with the job market and offers a dynamic academic environment. (Website: <https://www.iscte-iul.pt>);
- j) **University of Évora:** Founded in 1559 and reopened in 1979, it plays a key role in education and research, with a strong regional and cultural impact. (Website: <https://www.uevora.pt>);
- k) **University of Algarve:** Established in 1979, UAlg has three campuses and emphasises internationalisation, collaborating with various institutions and promoting student exchanges. (Website: <https://www.ualg.pt>);

### 3.5.2 Dependent Variables

The dependent variables in this study were usability, user experience (UX), and emotional induction:

- a) **Usability:** The aim of investigating this variable was to determine to what extent participants perceived the system as easy to use and effective in providing information. Usability was assessed through task completion time measurements, difficulty ratings for each task, and the USE Questionnaire. This questionnaire was based on four key criteria: usefulness, ease of use, ease of learning, and satisfaction. The evaluation included 30 items and two open-ended questions regarding the website's positive and negative aspects.
- b) **UX:** This variable was assessed using the UEQ, which evaluates six dimensions:
  - (a) Efficiency: Measures whether users can complete tasks without excessive effort;
  - (b) Attractiveness: Indicates users' overall feelings towards the product and their preferences;
  - (c) Perspicuity: Determines how quickly users can familiarise themselves with the product and understand how to use it;
  - (d) Stimulation: Measures whether using the product is engaging and stimulating;
  - (e) Dependability: Assesses whether users feel they have control over their interaction with the product;
  - (f) Novelty: Evaluates the level of innovation and creativity of the product and its ability to capture users' interest.
- c) **Emotional Induction:** This variable was examined to determine how participants' emotions were influenced by their interactions with the websites, using the PANAS method. Positive emotions can enhance users' motivation, memory retention, and problem-solving abilities [Isen and Reeve, 2005]. Participants were asked how they felt about each of the 20 items measuring emotions encountered during their experience. The positive emotion items included attentive, active, anxious, alert, determined, enthusiastic, interested, inspired, strong, and proud. The negative emotion items included frightened, apprehensive, nervous, aggressive, irritable, guilty, distressed, and bored.

These three dependent variables – usability, user experience, and emotional induction – were chosen because they complement each other in the study's design. Their interrelationship forms a methodological triangulation, combining both quantitative and qualitative methods. According to Duarte [2009], gathering and analysing data from different sources using varied strategies enhances the validity of results. Duarte argues that a hypothesis tested using multiple methods is more robust than one tested through a single approach.

The methodological tools associated with the three dependent variables incorporate both quantitative methodologies (task completion time measurement, USE Questionnaire, UEQ, and PANAS) and qualitative methodologies (open-ended questions). The integration of these methods

provides greater insight than if the variables were analysed separately [Duarte, 2009]. Duarte further states that, while quantitative methods tend to dominate research, qualitative methods play a crucial role in data collection, interpretation, and clarification: "Qualitative research plays an important role in the research process, for example in the development [...] of instruments for data collection, but also in the interpretation and clarification of quantitative data" [Duarte, 2009, p. 17].

### 3.6 Ethical Considerations

All participants provided informed consent prior to participation. The study collected only anonymised, non-identifiable data and participation was entirely voluntary. In accordance with Portuguese practice for anonymous online surveys with competent adult volunteers, this type of minimal-risk study did not require prior approval from an institutional ethics committee; nevertheless, the questionnaire and protocol were reviewed by an HCI academic and a UX specialist and a pilot test was conducted. Data were stored securely on password-protected systems and used only for research purposes, in compliance with GDPR.

## 4 Results

A total of 220 questionnaires were fully completed and analysed. In the following sections, results for usability, user experience, and emotional impact are presented.

### 4.1 Usability Analysis

This analysis evaluated the usability of the 11 Portuguese public university websites. It included two quantitative components (task completion times and the USE Questionnaire results) and two qualitative components (an open-ended question about task difficulty and an open-ended question about positive/negative aspects).

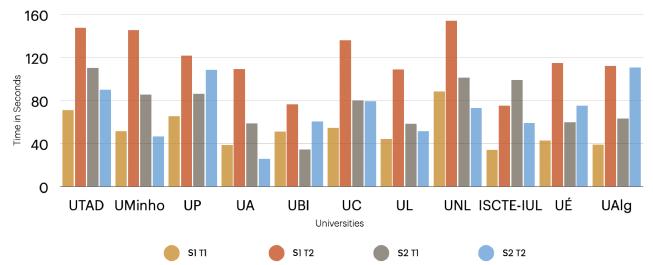
To support this evaluation, participants were asked to complete specific tasks within two realistic scenarios, as previously mentioned in section 3.2.

#### 4.1.1 Task Completion Time Measurement

The analysis revealed significant variations in task completion times, especially when searching for the school calendar, which often had high average times and high variability. UTAD, UMinho, UP, UA, UC, UNL and UÉ stood out for having longer average times, suggesting difficulties in navigating and locating information. The standard deviation was particularly high at UA, with times ranging from a few seconds to over 16 minutes. UL and ISCTE-IUL recorded lower average times, indicating that the hierarchy of information on these websites might be better structured. However, some universities, such as UAlg, had difficulties with other tasks (e.g., finding information about Social Action Services), showing problems with the organisation of information.

**Table 1** contains the average times taken to complete each task (in seconds), and the corresponding standard deviation,

for each university, while **Figure 1** provides a visual illustration of these results. Task 2 of Scenario 1 (finding the academic calendar) had the highest average times in almost all the universities (except ISCTE-IUL). In contrast, the task that appeared to be easiest was S1T1 (finding a course page), as it had more homogeneous and lower times overall. Overall, the results point to inconsistency in the usability of university websites: some sites exhibited dense and unintuitive menus leading to slow task performance, while others allowed more efficient navigation.



**Figure 1.** Average times taken to complete each task, by university.

#### 4.1.2 Task Difficulty (Open-Ended Question)

According to the open-ended feedback on task difficulty, most participants found it difficult to carry out some of the tasks proposed for each website, particularly the task of finding the school calendar (Scenario 1, Task 2), which was the most frequently cited as problematic. Many users reported that the information about academic calendars was not very clear on several sites, requiring multiple clicks and extensive navigation through menus. At UTAD, UMinho, UP, UA, UC, UNL, UÉ and UL, respondents often resorted to the search function to find the calendar, which in some cases did not yield good results either.

Difficulties in locating information on Academic Services (Scenario 2, Task 1) and Social Action Services (Scenario 2, Task 2) were also mentioned for several universities, such as UAlg, ISCTE-IUL and UBI. Some pages required users to navigate through unintuitive menus or hidden subpages to find this information.

These qualitative reports correspond with the longer task times observed: for instance, UA had a very high average time (190.5 s) for the calendar task (S1T2), and similarly high times were recorded for that task at UNL (154.08 s) and UC (136.02 s). By contrast, ISCTE-IUL and UL had much lower times for the same task, indicating potentially more efficient navigation structures on those sites.

Overall, the reported difficulties indicate structural problems and usability issues in many of the websites. Common pain points include unclear information architecture and overloaded menus, which hamper the user experience and efficiency in obtaining essential academic information.

#### 4.1.3 Negative and Positive Aspects (Qualitative Feedback)

The open-ended question about positive and negative aspects of each website revealed a varied user experience across institutions, with significant differences in perceived strengths

**Table 1.** Average times (in seconds) recorded and standard deviations for each task (S1T1, S1T2, S2T1, S2T2) at each university.

	S1T1		S1T2		S2T1		S2T2	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
UTAD	71.16	73.31	147.66	82.41	110.27	81.67	89.92	79.43
UMinho	51.74	29.71	145.41	88.56	85.38	56.68	46.54	39.39
UP	65.39	62.78	121.71	116.03	86.50	45.03	108.51	77.69
UA	38.90	63.60	190.50	266.10	58.90	126.30	26.10	60.41
UBI	51.16	31.95	76.62	112.97	34.65	33.50	60.75	60.41
UC	54.48	37.26	136.02	110.71	80.42	84.62	79.43	65.22
UL	44.34	22.12	108.85	66.62	58.43	58.26	51.64	48.28
UNL	88.44	67.76	154.08	97.57	101.29	55.81	73.01	55.85
ISCTE-IUL	34.31	29.69	75.24	51.71	99.24	62.26	59.13	57.75
UÉ	42.98	25.38	114.81	71.38	59.84	54.33	75.32	82.75
UAAlg	39.17	31.41	112.28	76.26	63.47	54.04	110.83	95.35

and weaknesses. We classified the responses into 11 categories representing key elements of web design and content: Navigation, Structure, Design, Interface (aesthetic and layout considerations), Responsiveness (mobile adaptation), Content, Information (clarity and accuracy of info), Functionality (interactive features, search, etc.), Resources (available features/tools), Technical Issues (performance, errors), and “None” (for responses indicating no particular positives/negatives).

Across the 11 universities, certain patterns emerged:

- **Positive aspects:** UL stood out with the most positive aspects mentioned (43 mentions), especially in terms of navigation and clarity of information. ISCTE-IUL also received many positive comments, highlighting intuitive navigation, a well-organised structure, and a minimalist design. UAAlg and UA were frequently praised for modern and visually appealing design. In contrast, UNL had the fewest positive aspects mentioned (13), often noting that its information was fragmented across multiple sub-sites (faculties).
- **Negative aspects:** UMinho had the highest number of negative aspects mentioned (47 mentions), mainly related to confusing navigation, disorganised menus and an overabundance of submenus. On the other hand, ISCTE-IUL had the fewest negative points (12), suggesting a comparatively smoother browsing experience. Navigation problems were the most common negative theme overall (raised for almost all universities except UÉ), indicating that many sites have issues with menu structure or links. Some participants criticised the Design of certain sites (e.g., UBI and UNL) for being outdated or lacking contrast, while others noted Content issues like too much text. The Structure of information was praised at some institutions (UC and ISCTE-IUL) for clear hierarchy, but also criticised at others for dispersing content (as at UTAD and UMinho, where important info like support services were hard to find).
- **Technical and responsiveness issues:** A few universities faced technical criticisms: UL, UMinho and UNL had users mention slow page loads or inefficient search bars. UTAD, UMinho and UBI were pointed out for poor responsiveness on mobile devices (e.g., formatting

problems on smaller screens).

**Table 2** summarises the frequency of positive and negative mentions extracted from the open-ended questions. The counts in Table 2 represent mentions (a respondent could mention multiple aspects), not unique respondents. Across the corpus, we recorded 357 negative mentions.

As seen on Table 2, Navigation was the most frequently cited negative category — it was reported as a problem for 10 of the 11 universities — underscoring that information architecture and menu structure are persistent pain points. For transparency and reproducibility, the full coded dataset (anonymised) and the coding frame are available in the project repository; researchers interested in participant-level prevalence (for example, the percentage of respondents who mentioned navigation at least once) can compute this directly from the shared data.

#### 4.1.4 USE Questionnaire Results

The USE Questionnaire assessed the perceived usability of each university’s website across the four dimensions of Usefulness, Ease of Use, Ease of Learning, and Satisfaction (each on a 1–7 scale). **Table 3** shows the mean scores for each dimension, as well as the overall **Total Usability** (the average of all USE items), for each website.

UL achieved the highest Total Usability score (4.8, or 68.57% of the maximum), followed closely by ISCTE-IUL (4.725, 67.50%) and UBI (4.7, 67.14%). In contrast, UNL and UMinho had the lowest overall scores, with 3.2 (45.71%) and 3.1 (44.29%) respectively, indicating a need for significant improvements to their usability.

Breaking down by dimensions:

- **Usefulness:** UBI, UL, ISCTE-IUL and UAAlg scored the highest, suggesting these websites better meet users’ needs in terms of functionality and content relevance. UMinho had the worst score on this dimension (3.2), pointing to difficulties users had in finding the sites useful for their intended tasks.
- **Ease of Use:** UL had the top score (4.9, 70%), followed by ISCTE-IUL and UBI (4.75, 67.86% each). UNL scored lowest (3.25, 46.43%), suggesting its navigation

**Table 2.** Summary of positive and negative aspect frequencies (from open-ended feedback) for each university's website, including the most commonly mentioned aspect in each case.

	Count of Positive Aspects	Count of Negative Aspects	Most positively mentioned aspect	Most negatively mentioned aspect
UTAD	25	31	Structure	Navigation
UMinho	24	47	Design	Navigation
UP	22	25	Design	Navigation
UA	36	38	Design	Information
UBI	33	31	Information	Navigation
UC	23	33	Structure/Design	Navigation
UL	43	43	Structure/Information	Navigation/Information
UNL	13	33	Design	Navigation/Information
ISCTE-IUL	34	12	Navigation	Navigation/Design
UÉ	35	34	Navigation	Structure/Information
UAlg	38	30	Design	Navigation

**Table 3.** Results of the USE Questionnaire.

	Total Usability		Usefulness		Ease of Use		Ease of Learning		Satisfaction	
	M	%	M	%	M	%	M	%	M	%
UTAD	3.65	52.14%	3.675	52.5%	3.85	55%	4.225	60.36%	2.5	35.71%
UMinho	3.1	44.20%	3.2	45.71%	3.35	47.86%	3.45	49.20%	2.65	37.86%
UP	4.3	61.43%	4.425	63.21%	4.3	61.43%	4.55	65%	3.8	54.20%
UA	4.275	61.07%	4.2	60%	4.3	61.43%	4.6	65.71%	3.7	52.86%
UBI	4.7	67.14%	4.6	65.71%	4.75	67.86%	5.325	76.07%	3.8	54.29%
UC	4.3	61.43%	4.25	60.71%	4.3	61.43%	4.675	66.79%	3.85	55%
UL	4.8	68.57%	4.525	64.64%	4.9	70%	5.375	76.79%	4.4	62.86%
UNL	3.2	45.71%	3.4	48.57%	3.25	46.43%	3.2	45.71%	2.7	38.57%
ISCTE-IUL	4.725	67.50%	4.6	65.71%	4.75	67.86%	5	71.43%	4.05	57.86%
UÉ	4.1	58.57%	4.175	59.64%	4.1	58.57%	4.6	65.71%	3.55	50.71%
UAlg	4.525	64.64%	4.625	66.07%	4.5	64.29%	4.9	70%	4.15	59.29%

and interface require substantial improvement to be considered easy to use.

- **Ease of Learning:** UL (5.375, 76.79%) and UBI (5.325, 76.07%) were best in this dimension, indicating users found it quick to learn how to use these sites. UNL (3.2, 45.71%) and UMinho (3.45, 49.29%) were the worst, implying steep learning curves or confusing design.
- **Satisfaction:** UL (4.4, 62.86%) and UAlg (4.15, 59.29%) led in user satisfaction, meaning users overall felt relatively positive about these experiences. UTAD had the lowest satisfaction score (2.5, 35.71%), reflecting a much less pleasant experience despite its moderate performance on some other metrics.

In general, the USE Questionnaire results show significant variability in usability across the universities. While UL, UBI and ISCTE-IUL appear to offer a reasonably good level of usability, UNL and UMinho clearly fall behind. Improving user satisfaction emerged as a common need for all websites, even those that scored well in other areas, indicating that aspects like aesthetics or engagement (not captured fully by basic usability metrics) may be lacking.

## 4.2 User Experience Analysis

The user experience was evaluated using the UEQ, which provides both absolute scores on six UX dimensions and a relative benchmark comparison against a broad database of other products' UX scores.

### 4.2.1 UEQ Scale Mean Values

Analysis of the UEQ mean values for the six dimensions – Attractiveness, Perspicuity, Efficiency, Dependability, Stimulation, and Novelty – showed that some universities performed well in certain aspects while others had significant difficulties. **Table 4** presents these mean scores.

The best-performing websites in UEQ terms were ISCTE-IUL, UL, UAlg and UBI. ISCTE-IUL stood out with positive values in Attractiveness (1.058), Perspicuity (0.950), Efficiency (1.200) and Dependability (1.013), indicating that users found this website not only appealing and easy to learn, but also effective for task completion and reliable in interaction – strong pragmatic qualities overall. UL also scored well, particularly in Efficiency (0.963) and Dependability (0.988). UBI showed a similar pattern with solid scores in Efficiency (0.950) and Dependability (0.825). UAlg was notable for a positive Attractiveness score (1.008) and good Efficiency (0.800) and Dependability (0.800), suggesting a well-rounded experience on that website as well.

On the other hand, several universities obtained neutral or negative average evaluations on many scales. UNL had particularly low scores, with negative means in Perspicuity (-0.925), Efficiency (-0.425) and Novelty (-0.700). This suggests users found UNL's website unclear and not easy to familiarize with, and they perceived it as lacking innovation. UMinho similarly scored poorly in Perspicuity (-0.850) and Novelty (-0.925), pointing to problems communicating information and a dated feel. In fact, **Novelty** was the worst dimension overall: no university achieved a positive score on

Novelty, and the lowest values were recorded for UTAD (-1.338), UMinho (-0.925) and UNL (-0.700). This indicates that users generally do not view these university websites as innovative, creative, or capable of arousing interest. Stimulation (which reflects how exciting or motivating the experience is) was also low across the board, though a few sites (like ISCTE-IUL with 0.71, UAlg 0.63) managed slight positive scores.

Looking at these in context, even the top performers did not reach extremely high scores on hedonic dimensions. This suggests that while some sites are functionally good, they may still lack elements that “delight” users or capture their interest. We will further interpret these results in comparison to benchmark data in the next section.

#### 4.2.2 UEQ Benchmark Comparison

The UEQ comes with a benchmark scale categorising mean scores into ranges (e.g., “Excellent”, “Good”, “Above Average”, “Below Average”, “Bad”) based on a large sample of other products. Using this reference, we compared each university’s dimension scores, as seen on **Table 5** to see how they fare relative to typical software or website UX:

- None of the university websites reached the “Good” category (the second-highest) on any UEQ dimension. According to the study by Schrepp *et al.* [2017], a digital product must reach at least the ‘Good’ category to be considered a platform with a good user experience. In most cases, even the better-scoring sites fell into the “Below Average” or at best “Average” range. For instance, ISCTE-IUL’s highest scores (1.0+) might be around the threshold of “Above Average”, whereas UL and UAlg had several scores in the slightly positive (but not high) range.
- This finding reinforces that, compared to modern user experience standards, these university websites collectively underperform. Even dimensions like Attractiveness and Efficiency, where a few sites did relatively well, did not stand out strongly against industry-wide benchmarks.
- The consistently low Novelty scores likely correspond to at best a “Below Average” or “Bad” categorisation in the benchmark, highlighting a systemic issue: these websites tend to be seen as conventional or uninspiring.

Overall, the benchmark comparison underscores the pressing need for improvements not only in basic usability but also in making these websites more appealing and stimulating to users. The current state suggests that Portuguese university sites lag behind the UX quality of many other digital products that users interact with, which could negatively affect user engagement.

#### 4.3 Emotions Analysis (PANAS)

Finally, the PANAS results (**Table 6**) provide the average positive affect and negative affect scores reported by users after using each website. Each PANAS score is the sum of 10 items (ranging from 10 to 50, for each of Positive and Negative affect).

UL’s website stands out with the highest Positive Affect index (24.85 out of 50 on average), indicating that users felt comparatively higher levels of enthusiasm, interest and other positive emotions when using that website. UBI follows closely (24.25), and UA also shows a fairly high positive score (23.45). Other institutions such as UP, UC, ISCTE-IUL, UÉ and UAlg had positive affect averages above 20, which we can interpret as users experiencing some positive emotions at satisfactory levels on those sites. In contrast, UMinho (19.5) and UNL (20.0) had the lowest positive affect scores, suggesting users of those sites felt less interested or excited, possibly due to the frustrations or difficulties noted earlier.

Regarding Negative Affect, UBI’s website had the lowest average negative score (11.3), meaning users of UBI felt very little anxiety, frustration or upset while browsing. Similarly, UP (12.45), UL (12.7), ISCTE-IUL (12.75), UÉ (12.5) and UAlg (12.15) all show low negative affect, implying that these sites did not induce many negative emotions. On the other hand, UMinho (17.6) and UNL (16.4) show the highest negative affect scores – users of these sites did report appreciable levels of negative feelings such as irritation or confusion, aligning with the usability/UX problems identified. UTAD (13.75), UA (15.05) and UC (13.6) fall in between, indicating moderate levels of negative affect.

Combining these results: the universities that scored best in usability and UX (e.g., UL, UBI, ISCTE-IUL, UAlg) are generally among those with higher positive affect and lower negative affect, whereas those with poor usability/UX (UMinho, UNL) show the opposite pattern. This suggests a correlation whereby a better user experience contributes to more positive emotions and fewer negative ones – an expected relationship consistent with UX theory.

## 5 Discussion

Our findings reveal significant discrepancies in the usability, user experience, and emotional impact of the evaluated university websites. Some universities’ sites performed well, providing relatively efficient and satisfying interactions, whereas others clearly struggled to meet users’ needs. ISCTE-IUL, UL and UBI emerged as the top performers in terms of usability metrics, each achieving over 67% of the maximum USE Questionnaire score. In contrast, UNL and UMinho’s websites had the lowest usability scores, reflecting issues such as poor information organisation and difficult navigation. Notably, user satisfaction was the lowest-rated aspect across all institutions, indicating that even the better-performing websites failed to truly delight users or provide a pleasurable experience.

These results can be interpreted in light of existing literature. The prevalence of navigation and structure problems echoes prior studies emphasizing that clear information architecture is critical for effective university websites [Hosseini *et al.*, 2021]. When sites had intuitive menus and a logical hierarchy (e.g., ISCTE-IUL, UAlg), users responded with praise, whereas fragmented or confusing structures (as seen with UNL or UMinho) led to frustration. This aligns with user-centered design principles that stress the importance of

**Table 4.** UEQ scores by dimension for each university website.

	Atractiveness	Perspicuity	Efficiency	Dependability	Stimulation	Novelty
UTAD	-0.208	0.000	-0.050	0.325	-0.413	-1.338
UMinho	-0.542	-0.850	-0.363	-0.363	-0.663	-0.925
UP	0.708	0.188	0.663	0.375	0.288	-0.013
UA	0.783	0.425	0.863	0.575	0.488	0.163
UBI	0.717	0.588	0.950	0.825	0.325	-0.663
UC	0.517	0.163	0.363	0.425	0.325	0.288
UL	0.808	0.788	0.963	0.988	0.500	-0.100
UNL	-0.308	-0.925	-0.425	-0.313	-0.588	-0.700
ISCTE-IUL	1.058	0.950	1.200	1.013	0.713	0.038
UÉ	0.450	0.138	0.450	0.538	0.313	-0.388
UAlg	1.008	0.625	0.800	0.800	0.625	0.375

**Table 5.** Mean UEQ scores, by dimension for each university website, when compared with the the UEQ benchmark (where 0 represents an average user experience).

	Atractiveness	Perspicuity	Efficiency	Dependability	Stimulation	Novelty
UTAD	0.21	0.00	-0.05	0.33	-0.41	-1.34
UMinho	-0.54	-0.85	-0.36	-0.36	-0.66	-0.93
UP	0.71	0.19	0.66	0.38	0.29	-0.01
UA	0.78	0.43	0.86	0.58	0.49	0.16
UBI	0.72	0.59	0.95	0.83	0.33	-0.66
UC	0.52	0.16	0.36	0.43	0.33	0.29
UL	0.81	0.79	0.96	0.99	0.50	-0.10
UNL	-0.31	-0.93	-0.43	-0.31	-0.59	-0.70
ISCTE-IUL	1.06	0.95	1.20	1.01	0.71	0.04
UÉ	0.45	0.14	0.45	0.54	0.31	0.39
UAlg	1.01	0.63	0.80	0.80	0.63	0.38

**Table 6.** Average Positive and Negative Affect scores (PANAS) for each university website (on a scale ranging from 10 to 50).

	Positive Affect	Negative Affect
UTAD	20.05	13.75
UMinho	19.5	17.60
UP	20.45	12.45
UA	23.45	15.05
UBI	24.25	11.30
UC	22.80	13.60
UL	24.85	12.70
UNL	20.00	16.40
ISCTE	23.70	12.75
UÉ	23.00	12.50
UAlg	22.70	12.15

visual hierarchy and familiar navigation paths in driving satisfaction.

Another key observation is the uniformly negative evaluation of “Novelty” in the UX scores. Users generally perceived all the websites as lacking innovation or creative appeal. While university websites often prioritise consistency and information delivery over flashy features, the absence of engaging elements may contribute to the low stimulation and low satisfaction findings. In practical terms, this means that even sites which are usable and functional might still be seen as boring or outdated. From a theoretical perspective, this shortcoming suggests a missed opportunity to engage users on Norman’s reflective level of emotional design,

where aspects like innovation and brand personality play a role [Norman, 2004]

The relationship between usability/UX performance and user emotions was clearly evident in our results. The websites with the best usability and UX scores (notably UL, UBI, ISCTE-IUL, and also UA to some extent) were among those that elicited the most positive emotions (higher PANAS positive affect) and minimal negative emotions. Conversely, the poorest sites in terms of UX (UMinho, UNL) corresponded to the highest negative affect scores, reflecting user frustration. This correlation supports the idea that improving pragmatic quality (usability) can directly enhance how users feel during the interaction. It is consistent with prior findings in HCI that positive user experiences tend to generate positive affect, which can further increase users’ motivation and satisfaction [Isen and Reeve, 2005]. Thus, our study provides empirical backing, in the context of university websites, for the intuitive hypothesis that “websites that work well make users feel good.”

Beyond individual metrics, it is important to discuss each university’s website in terms of its unique strengths and weaknesses, and to offer tailored recommendations for improvement. Below, we provide a brief analysis for each institution’s website, summarising what the users found and what could be improved:

- **UTAD:** The UTAD website had moderate usability performance but suffered from very low Novelty. Users appreciated its information structure when it was clear, but reported significant navigation difficulties (long times

to find content) and poor mobile responsiveness. *Recommendation:* Simplify and reorganise the navigation menus (to reduce the number of clicks needed for key tasks), and modernise the visual design to make the interface more engaging. Address mobile layout issues to ensure content is accessible on smaller screens.

- **UMinho:** UMinho's website was one of the worst performers in both usability and UX. Participants most frequently complained about confusing navigation, disorganized menus with too many sub-levels, and fragmented information. Positive remarks were scarce aside from some noting the visual design was clean. *Recommendation:* Conduct a thorough redesign of the information architecture – consolidate pages and menus to eliminate redundancy, ensure that important information is centralized rather than scattered. Improve navigation cues and reduce complexity (e.g., limit submenu depth). Also, address technical issues like slow loading times and ensure the search function yields relevant results.
- **UP:** The University of Porto's website had average results overall. Users' feedback indicated some design strengths (it is visually appealing) but also navigation issues (task times were somewhat high and navigation was commonly mentioned as a negative). *Recommendation:* While maintaining the strong visual identity, UP should refine its navigation structure – for instance, improve the menu labels and grouping of content – and possibly provide better on-site search or quick links to frequently sought information (like calendars and contacts).
- **UA:** The University of Aveiro's website yielded mixed outcomes. It received praise for modern design and aesthetics, which likely contributed to relatively high positive emotion scores. However, it had one of the highest task completion times for finding the academic calendar, reflecting information architecture issues. *Recommendation:* Enhance the clarity and organisation of informational content – especially academic schedules and administrative services – perhaps by creating dedicated, easy-to-find sections for these common queries. Additionally, optimise the internal search tool to help users find specific documents or pages more quickly. UA can leverage its appealing design as a foundation, but must ensure important content is not buried.
- **UBI:** The University of Beira Interior's website performed well in usability and generated among the highest positive emotions, indicating a generally good UX. Users specifically found the content information clear (many positive mentions) and tasks easy to learn. Some negatives were related to navigation (there is still room to make it more seamless) and critiques that the design felt a bit dated. *Recommendation:* UBI should preserve the clarity of information presentation while introducing small design updates to keep the interface fresh (e.g., improving contrast, updating fonts or visuals). Navigation could be further improved by streamlining menus – even though UBI did fairly well, removing any remaining pain points (like repetitive links or unclear labels) could elevate satisfaction even more.

• **UC:** The University of Coimbra's website showed moderate usability. Users appreciated aspects of its structure and design (some found the hierarchy clear and the look respectable), but also reported navigation challenges and technical issues (like a less effective search and occasional slowness). *Recommendation:* UC could improve by focusing on user pathways: ensure that common tasks (finding contacts, schedules, course info) are achievable in a few intuitive steps. Improving the search functionality is also important, as users often resort to search when navigation fails – the search should reliably direct users to relevant sections of UC's extensive website. Given UC's large amount of content, maintaining consistency and speed across all subpages (perhaps through performance optimisations) will help reduce user frustration.

• **UL:** The University of Lisbon's website was among the top performers in measured usability and UX, yet it also had a relatively high count of negative comments (equal in number to positive comments). This indicates that while it excels in some metrics (like efficiency and dependability), it still has shortcomings. Users liked the structure and clarity of information (UL had the most positive mentions, often citing those), but they also noted navigation and information as issues on the negative side, possibly because UL's content is spread across various faculty websites. *Recommendation:* UL should continue to build on its strong points by further unifying the user experience across different sub-sites. For example, implementing a more integrated navigation system that links faculty pages with the main portal in a seamless way would help users not feel "lost" or forced to reorient when moving between sections. Additionally, addressing any technical problems (some users mentioned slowness or search issues) will solidify UL's usability leadership.

• **UNL:** NOVA University Lisbon's website was a clear outlier on the low end of performance. It suffered from negative scores on several UX dimensions and high negative affect. Users identified navigation and information disorganisation as top problems, and its aesthetic/design was also criticized despite a few positive notes. The fragmentation between different faculties' pages was specifically pointed out as confusing. *Recommendation:* UNL should undertake a comprehensive redesign. A key step would be to create a unified design template for all its faculty and department pages, so that users have a consistent navigation experience throughout. Simplifying menus and providing a central hub or directory for information currently split across multiple sites would reduce fragmentation. Modernising the visual design to be more engaging could also help address the lack of Novelty – introducing more interactive features or up-to-date graphics could capture user interest. Essentially, UNL needs a more centralized, user-centric approach to its web presence.

• **ISCTE-IUL:** This website was among the best, with users praising its navigation and design. The website's minimalist, intuitive interface clearly paid off in both quantitative scores and low negative feedback. The

only relatively weak point in UEQ was Novelty (which was neutral). *Recommendation:* ISCTE-IUL should continue its current design philosophy, as it's largely successful. The focus can be on incremental improvements: for example, adding small innovative elements (without cluttering the interface) to increase engagement – perhaps personalized content for frequent users or integrating social media/news feeds to keep the website feeling dynamic. Ensuring that the website keeps up with responsive design trends and accessibility standards will further strengthen its position.

- **UÉ:** The University of Évora's website had fairly balanced positive and negative feedback. Users commonly mentioned good navigation (it was one of the few not criticized heavily for navigation) as a plus, but pointed out issues with structure and information (implying some content might be hard to find or not well-organized). *Recommendation:* UÉ can capitalize on its decent navigation by refining the underlying content structure. This might involve rethinking how information is grouped – if certain important information (like support services or program details) was frequently missed by users, it should be made more prominent or accessible. Additionally, updating content to ensure it's current and trimming any outdated or redundant pages can improve the overall user perception of the website's usefulness.
- **UAlg:** The University of Algarve's website scored well on usability and had many positive design comments. Users liked its modern design, but as with most others, navigation was still a commonly mentioned negative aspect. Some users possibly had trouble with certain menus or finding specific services. *Recommendation:* UAlg should audit its navigation structure to identify any labels or menu groupings that confuse users. Because its design is appealing, ensuring that substance (content findability) matches style is the goal. For example, UAlg could implement clearer calls-to-action on the homepage for key user tasks (like "Apply Now", "Academic Services", "Course catalogue") to guide users directly to popular content. Regular user testing on new students or external users could help pinpoint any lingering navigation issues to fix.

By addressing the issues noted above, each institution can significantly enhance its website's user experience. Importantly, many of these recommendations (e.g., simplify navigation, unify design, improve search) are aligned with best practices in web design and usability and would benefit all users, not just those in our study.

From a broader perspective, these findings have implications for institutional digital policy and strategy. Public universities in Portugal (and elsewhere) are increasingly expected to maintain an effective online presence as part of their service to students and the community. The pervasive navigation and usability problems identified suggest that many universities may need to invest more in user-centred design processes when developing their sites. Aligning improvements with national digital transformation initiatives – such as Portugal's *Iniciativa Nacional para a Competência*

*Digital e.2030* (Portugal INCoDe.2030), which among other goals encourages enhancing online services in education – could provide not only better UX but also support policy targets for digital accessibility and inclusivity. Ensuring compliance with accessibility standards (e.g., WCAG 2.1) is another critical aspect: our study did not directly measure accessibility, but the literature (e.g., Akgül [2021]) suggests many university sites have accessibility shortcomings. Addressing those in tandem with usability will ensure that the websites serve all users, including those with disabilities or using assistive technologies.

It is also worth noting some limitations of our study. We evaluated a snapshot of the websites between late 2023 and mid 2024; these sites are living systems that may undergo changes (some universities might have redesigned pages since the evaluation period). Additionally, our participant pool was confined to students; the experience of other user groups (e.g., international applicants, researchers, or older users like parents) might differ. Nonetheless, the student perspective is crucial given they are primary users, and the large sample (n=220) provides a robust basis for our conclusions.

Finally, the results and recommendations from this work open up several avenues for future research. Subsequent studies could track the progress of these university websites over time – do usability scores improve after interventions are made? A longitudinal study might capture the impact of any redesigns or incremental improvements post-evaluation. Expanding the scope to include private university websites or institutions from other countries would also offer valuable comparative insights (for example, identifying whether the issues we found are common globally or more specific to the Portuguese context). Additionally, further research can delve into aspects we identified but did not explore in depth, such as conducting formal accessibility evaluations, analysing the experiences of different demographic groups (to see if, say, gender or familiarity with technology influences UX on these sites), or even using sentiment analysis on open feedback to automatically gauge user emotions. The incorporation of emerging technologies – like using artificial intelligence to personalise content or chatbots to assist with navigation – also warrants investigation. For instance, one could study how an AI-driven virtual assistant on a university website might improve task success rates or user satisfaction, as well as any potential drawbacks such technology might introduce.

## 6 Conclusion

This study analysed the usability, user experience and emotions induced by the websites of all public universities in mainland Portugal, identifying their strengths and areas for improvement. The evaluation combined quantitative metrics and qualitative feedback from 220 student users. The results revealed that although some universities – such as UL, ISCTE-IUL and UBI – obtained relatively good ratings in usability and user experience, others (notably UNL and UMinho) presented significant difficulties, especially in terms of information organisation and navigation. The UEQ results indicated that *no* university's website reached a

“good” user experience benchmark on any dimension, highlighting the overall need for improvement. ISCTE-IUL stood out positively on several UX scales, whereas UTAD, UMinho, UNL and UÉ were among the weakest performers in various aspects. The PANAS emotional analysis confirmed that websites with better usability and UX generally generated more positive emotions in users, while those with usability issues aroused more frustration and disorientation.

Navigation and information structure emerged as crucial factors for user satisfaction across the board. Well-organised and intuitive websites (like those of ISCTE-IUL and UAlg) were praised, whereas UNL and UMinho were heavily criticised for fragmented content and confusing menus. Common recommendations for all institutions include modernising the design (to avoid outdated layouts and improve visual appeal), optimising the search function, and improving responsiveness for mobile devices. These steps would increase the efficiency and accessibility of the sites, directly addressing many issues identified in the study. In practical terms, universities should invest in reorganising information architecture, simplifying navigation paths, and implementing user-centred design solutions to create a more intuitive and enjoyable digital experience. Many of the problems we identified (such as unclear navigation labels or lack of unified design) can be resolved through a combination of user testing, iterative design, and adherence to established web usability guidelines.

It is evident that careful and strategic design interventions have the potential to substantially improve not only the functional usability of these websites but also the overall user experience and the emotions they evoke. By fostering more engaging, accessible, and user-friendly online platforms, universities will better meet the needs of their stakeholders and leave a more positive impression of the institution. Moving forward, we suggest that future work could explore the integration of new technologies and approaches – for example, assessing the impact of artificial intelligence-driven personalisation or conversational interfaces (chatbots) on the user experience of university websites. Additionally, longitudinal studies can measure how the UX of these websites evolves, especially if redesign efforts are undertaken as a response to findings such as ours. Expanding the research to include other user groups (faculty, international students, etc.) and performing detailed accessibility audits would also provide a more holistic evaluation of these critical digital platforms. By continually evaluating and refining their websites, public universities can ensure they remain effective, welcoming, and inclusive digital gateways to higher education.

## Declarations

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## Authors' Contributions

Maria Inês Albuquerque was responsible for the conceptualisation of the study, data collection, analysis, and the initial drafting of the manuscript. Joana Casteleiro-Pitrez contributed to the design of the study, literature review, data interpretation, and critically revised the manuscript for important intellectual content. Both authors read and approved the final manuscript.

## Competing interests

The authors declare that they have no competing interests.

## Availability of data and materials

In line with open science practises, all data collected in this study (anonymised responses) and the materials used (questionnaire form, screenshots of each university's homepage during the evaluation period) are available on the following online repository: <https://github.com/minesalbuquerque/HEI-UX-PT>. This ensures that the results are reproducible and that other researchers or institutions can reuse the findings.

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## **A Universities' Homepages**



Figure 2. UTAD – homepage (screenshot captured: 30 May 2023).

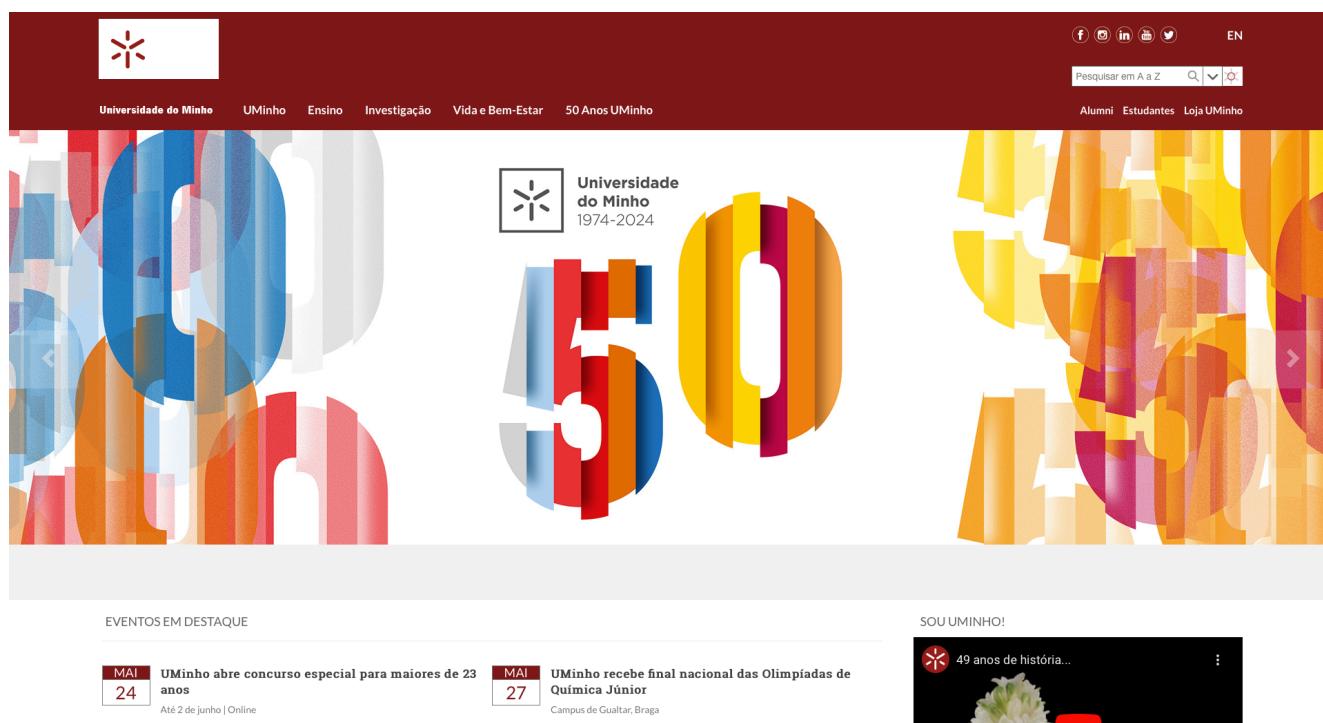


Figure 3. UMinho – homepage (screenshot captured: 30 May 2023).



## Uma Universidade de Excelência!

Com mais de 100 anos de história, a Universidade do Porto é uma instituição de ensino e investigação científica de referência em Portugal e no mundo.

Considerada a melhor Universidade Portuguesa e uma das 100 melhores instituições europeias segundo os mais importantes rankings do Ensino Superior, a U.Porto combina o ensino de qualidade e a investigação de excelência com a melhor experiência académica.

Figure 4. UP – homepage (screenshot captured: 30 May 2023).



Figure 5. UA – homepage (screenshot captured: 30 May 2023).

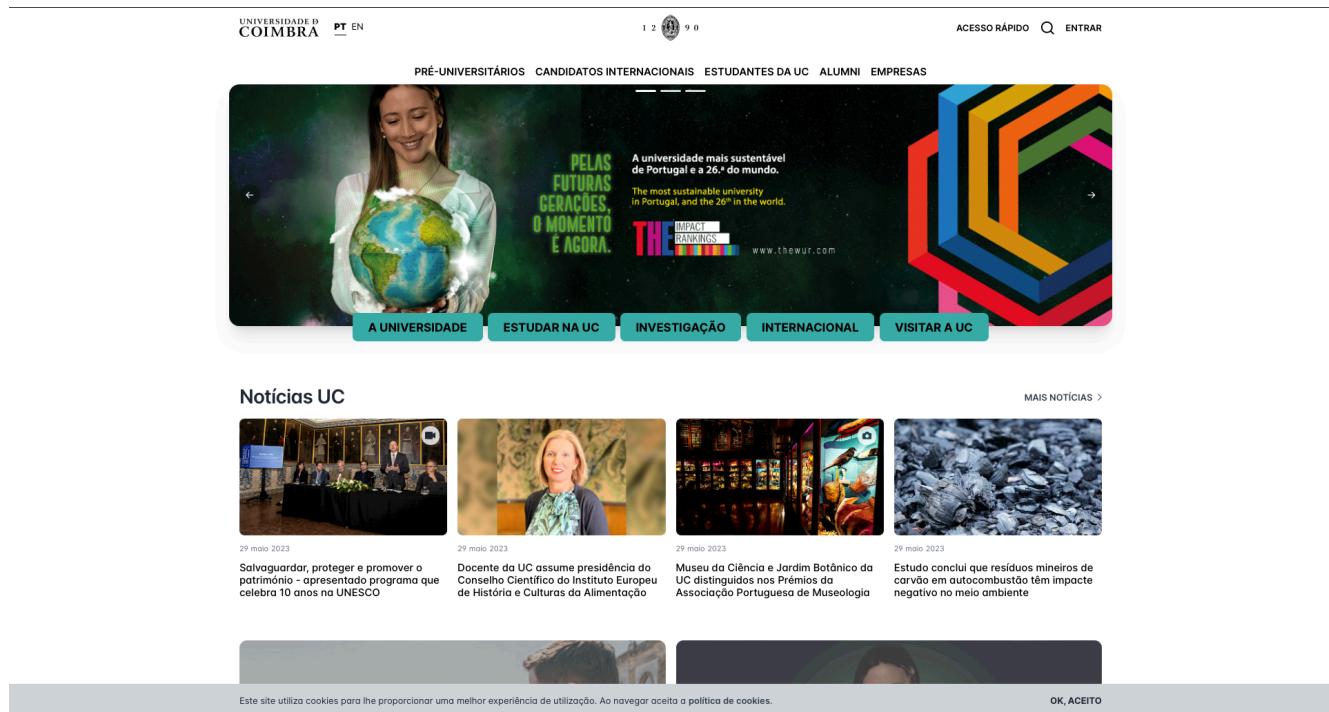


Figure 6. UC – homepage (screenshot captured: 30 May 2023).

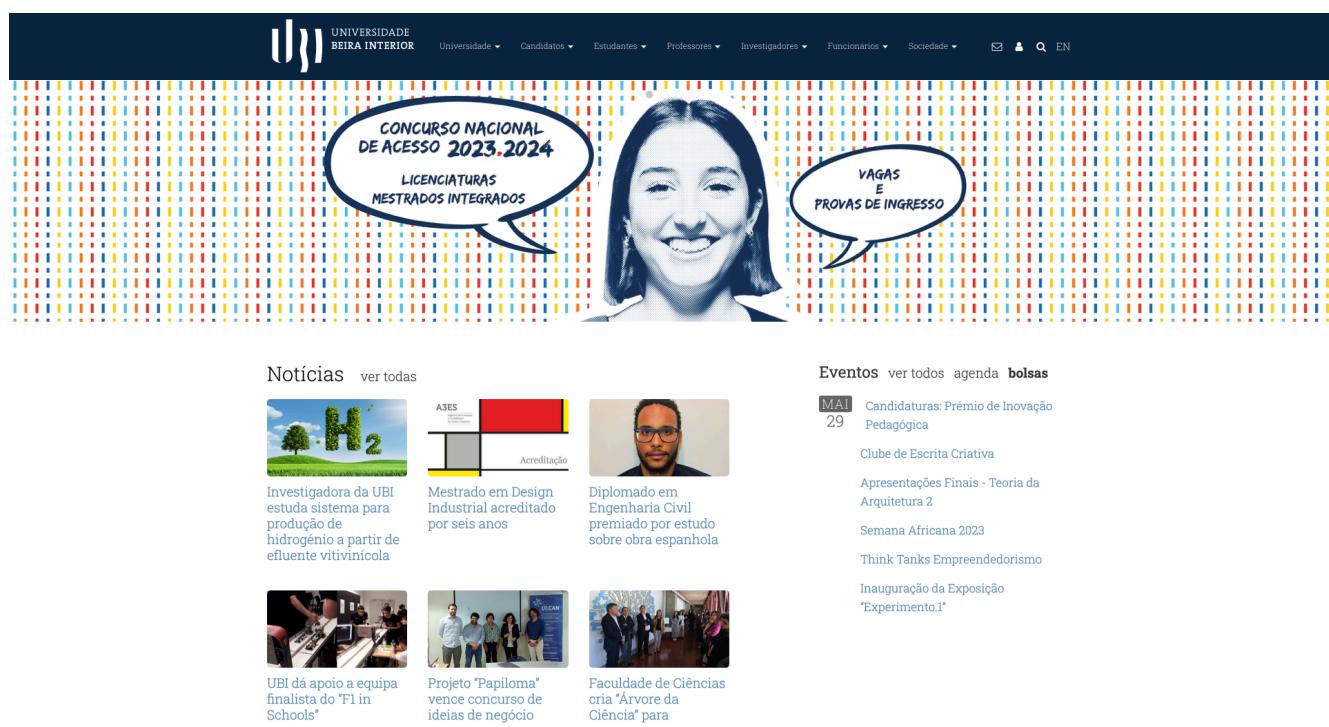


Figure 7. UBI – homepage (screenshot captured: 30 May 2023).

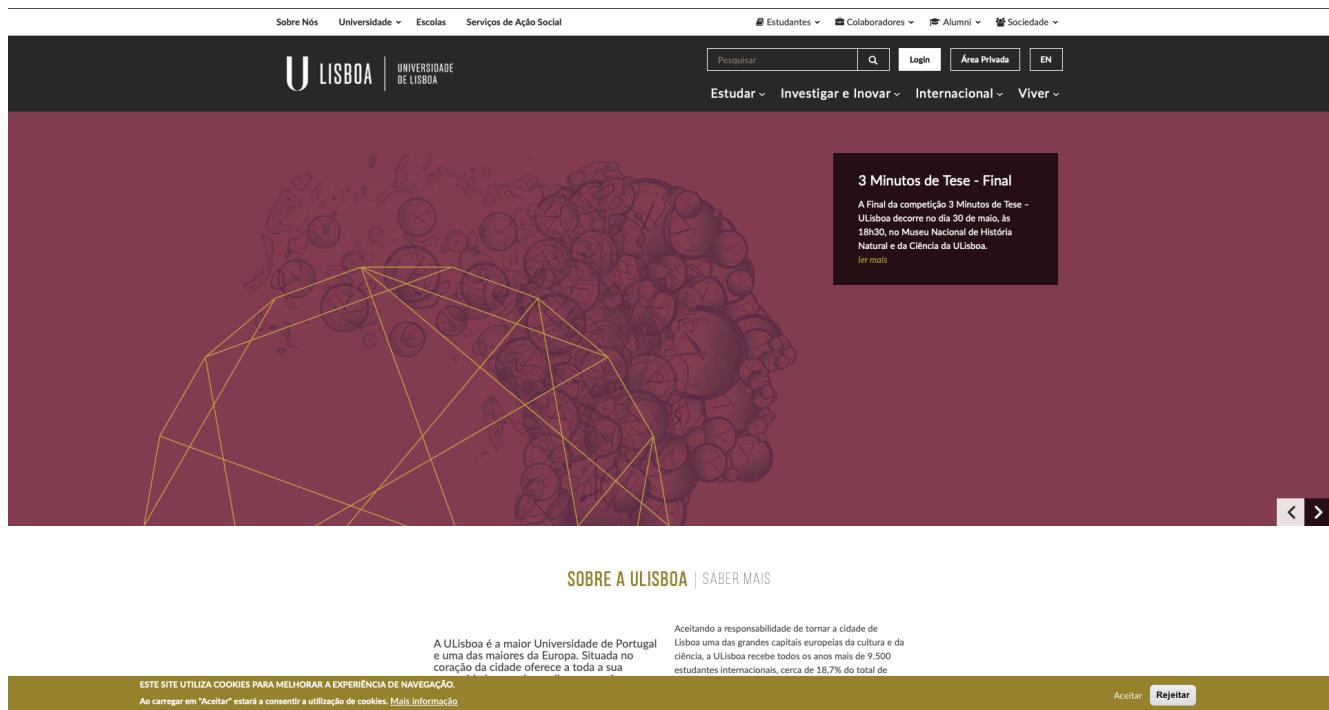


Figure 8. UL – homepage (screenshot captured: 30 May 2023).



Figure 9. UNL – homepage (screenshot captured: 30 May 2023).



Figure 10. ISCTE-IUL – homepage (screenshot captured: 30 May 2023).



Figure 11. UÉ – homepage (screenshot captured: 30 May 2023).

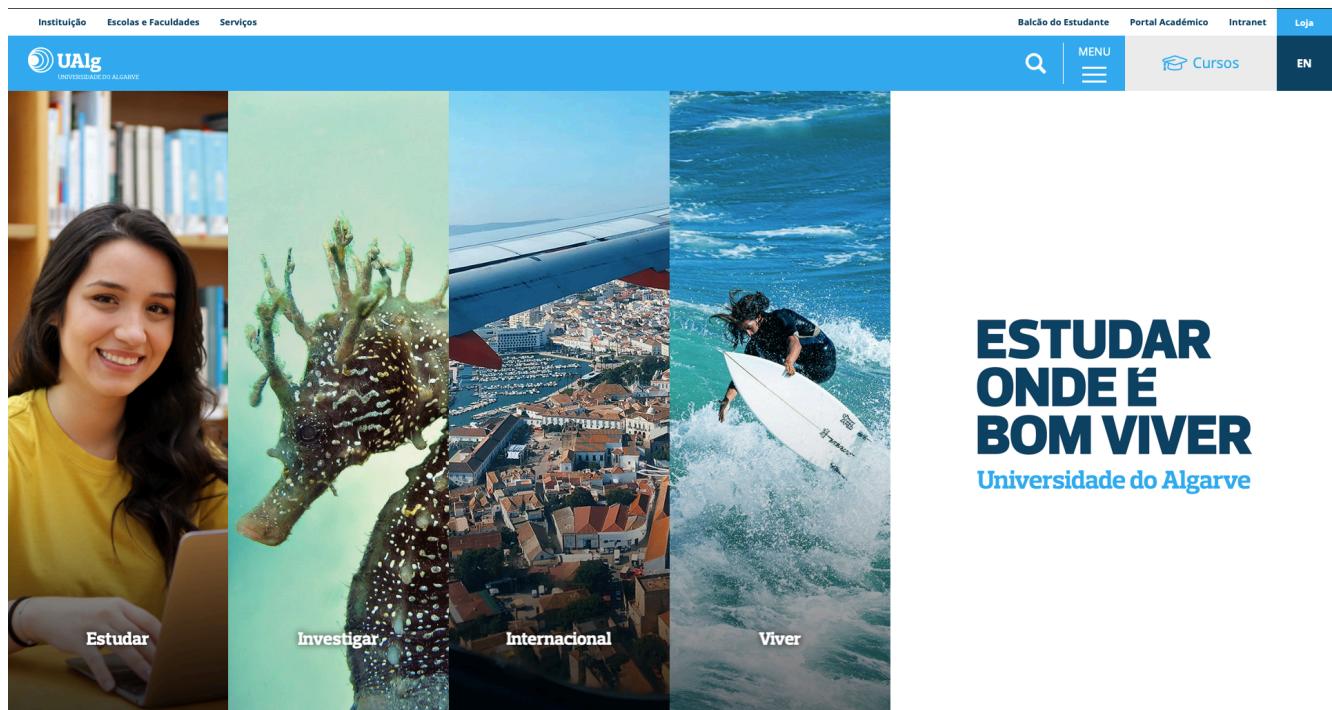


Figure 12. UAlg – homepage (screenshot captured: 30 May 2023).