Table of Contents

List of Tables

ABSTRACT :

Dipping with communication is fundamentally a necessary key for a clear communication between the least , that is how our world of digital **Ex changeability** is evolving . Including in the web surface , many web-based services are including a strongly affirmative and user friendly User interface for the other end . as the *international Organization for Standardization* (OSI) and *World Wide Web Consortium* (W3C) standardized the accessibility of the web to all the users by a base-guideline called WCAG (Web Content Accessibility Guidelines).

INTRODUCTION :

In today's digital era, university websites serve as essential platforms for delivering academic information, facilitating administrative services, and supporting communication between institutions and users. These websites are used by a wide variety of users students, faculty, researchers, and prospective applicants who rely on them for accessing course details, registration systems, announcements, and academic resources. A well-designed university website should provide a smooth and intuitive user experience, offering accessible, accurate, and clearly structured content. However, poor usability, inconsistent navigation, or lack of feedback can result in user frustration, information overload, and errors. For this reason, evaluating the ergonomics and usability of such websites is essential to ensure efficiency and user satisfaction. This project focuses on the heuristic and experimental evaluation of two university websites: The website of the Higher Institute of Applied Sciences and Technology of Mateur(ISSATM): http://www.issatm.rnu.tn/fr/index.php The website of TEK-UP University: https://tek-up.de/ Both sites were evaluated using Jakob Nielsen's 10 usability heuristics and through experimental testing with users from different experience levels. The goal is to assess the strengths and weaknesses of the two interfaces and to identify specific areas for improvement based on actual user interaction. This report is organized into the following sections:

Section 1: Research Method: A detailed overview on how we approached , organized and selected our framework for the evaluation of each website using Nielsen's 10 usability principles, with observations, examples, and comparison . Section 2: Methodology : how we selectively thought of a design approach and selected the necessary tool for the work and collected the data needed for the evaluation Section 3: Result Study : discuss the final result of our approach to achieve both of the heuristically evaluation and the experimental and gave some recommendation on how we can approve the platforms and finally we summaries everything with a conclusion

RESEARCH METHOD :

In this study we will put these guidelines to the test but conducting a full heuristic and an experimental evaluation on some giving websites , we will take our sample of study the official website of [The Higher Institution of Applied Science and Technology and of Materur] and TEK-UP University official website . For our research we will use two primary method , Heuristic and and Experimental Evaluation to see how our samples will respond to the general standard guidelines (responsiveness , availability , design .. etc)

Web Content Accessibility Guidelines (WCAG) :

[1] There are millions of people who have disabilities that affect their use of the Web. Web accessibility aims to help these people to perceive, understand, navigate, and interact with, as well as contribute to, the Web, and thereby the society in general. This accessibility is, in part, facilitated by the Web Content Accessibility Guidelines (WCAG) currently moving from version one to two , These guidelines are intended to encourage designers to make sure their sites conform to specifications, and in that conformance enable the assistive technologies of disabled users to better interact with the page content .

HEURISTIC EVALUATION :

A **heuristic evaluation** is a method for identifying design flaws in a user interface. Evaluators judge the design against a set of guidelines (called heuristics) that make systems easy to use. Heuristic evaluations are useful for identifying glaring problems in an interface. That interface can be just about anything that users will interact with including prototypes, physical products, games, virtual reality, or voice interfaces. The method can be particularly helpful early in the design process. Heuristic evaluations are **useful for stretching a limited UX research budget,** because they help you find likely issues without having to test with participants. However, **heuristic evaluations cannot replace user research**. User-experience design is highly contextual. To design good experiences, you'll still need to test with actual users. But heuristic evaluations can complement your team's research work; for example, conducting a heuristic evaluation in preparation for an upcoming usability test might help you identify the elements of the design that you should target during testing. [2]

Heuristic Criteria of Bastien and Scapin :

Bastien and Scapin developed a set of ergonomic criteria for evaluating user interfaces. These criteria focus on usability aspects such as user guidance, workload, error management, and consistency. Their framework emphasizes the importance of designing interfaces that support users effectively while minimizing cognitive load and errors. The criteria are grouped into categories like guidance (e.g., feedback and prompts), workload reduction (e.g., minimizing redundant actions), error prevention, and adaptability to user needs

Heuristic Criteria of Nielson :

Jakob Nielsen's 10 usability heuristics are widely used for heuristic evaluations. These include principles such as:

- **:** Keeping users informed about what is happening.
- **:** Using familiar language and concepts.
- **:** Allowing users to undo actions easily.
- **:** Ensuring uniformity in design.
- **:** Designing systems to minimize errors.
- **:** Reducing memory load by making options visible.
- **:** Supporting both novice and expert users.
- **:** Avoiding unnecessary information.
- **:** Providing clear error messages.

EXPERIMENTAL EVALUATION :

Experimental evaluation is a critical phase in scientific research that systematically assesses the validity, performance, and reliability of a proposed method, model, or hypothesis under controlled conditions. This process involves designing rigorous experiments to test predefined objectives, often comparing the proposed approach against established baselines or alternative solutions. Key steps include defining measurable metrics (e.g., accuracy, efficiency, error rates), selecting appropriate datasets or experimental setups, and ensuring reproducibility through detailed documentation of parameters, tools, and environmental conditions. Statistical analyses, such as hypothesis testing or confidence intervals, are employed to quantify significance and mitigate random variability. Limitations, biases, and external factors that may influence outcomes are carefully acknowledged to contextualize results. By objectively validating

theoretical claims with empirical evidence, experimental evaluation not only strengthens the credibility of the research but also provides actionable insights for future refinement or real-world application.

METHODOLOGY :

Study Design

We conducted a **fully automated evaluation** of two educational institution websites ISSATM, and TEK-UP) using a custom-built bot. This bot performed two parallel analyses:

- **Heuristic Evaluation**: Automated checks against **Nielsen's 10 Usability Heuristics** and **Bastien & Scapin's ergonomic criteria**.
- **Experimental Evaluation**: Simulated user interactions to measure task performance metrics (e.g., time, errors). The bot leveraged Python libraries (`selenium` , `bs4` , `pandas`) to execute tasks, parse HTML/CSS, and generate structured CSV reports. The bot emulated two user profiles to mirror human behavior:
- **Expert Mode**:
  - Direct navigation (predefined efficient paths using `selenium`).
  - Assumed familiarity with institutional website structures.
- **First-Time Mode**:
  - Exploratory behavior (randomized clicks, backtracking via `numpy`).
  - Simulated confusion (e.g., delayed actions, repeated errors).

Task Scenarios

The bot executed the following core tasks across all websites:

1. **Find a Specific Course**: Navigate to target pages (e.g., "Licence Appliquée en Technologies de l'Informatique").
2. **Locate International Partnerships**: Identify relevant sections via menu parsing (`bs4`).

3. **Retrieve Contact Information**: Extract phone/email data from footer or "Contact Us" pages.
4. **Access Registration Details**: Track paths to admission/registration forms.

Data Analysis :

Quantitative Analysis

- `pandas & numpy` : Calculated mean task time, error rates, and SUS-like scores from success/error ratios.
- `matplotlib` : Generated visualizations (e.g., heatmaps of navigation paths).

Qualitative Analysis

- **Pattern Detection**: Mapped CSV-reported issues (e.g., "poor button grouping") to Bastien & Scapin's "Guidance" criteria.
- **Root Cause Identification**: Linked experimental failures (e.g., high error counts) to heuristic violations (e.g., inconsistent labels).

Ergonomic Alignment

- Cross-referenced bot findings with Nielsen's heuristics (e.g., "Visibility of System Status") and Bastien & Scapin's principles (e.g., "Workload Reduction").

Evaluation Procedure

HEURISTIC EVALUATION (BASED ON NIELSEN'S HEURISTICS) :

The heuristic evaluation is a method used to assess the usability of an interface by comparing it against established principles. For this evaluation, we used Jakob Nielsen's 10 usability heuristics, which are widely recognized for identifying usability flaws in websites and applications. Each website ISSATM , TEK-UP was reviewed according to these heuristics to identify usability issues, interface strengths, and areas for improvement. Observations were noted for each heuristic, focusing on how effectively the sites support user interaction

Detailed Evaluation of the ISSATM Website :

Heuristic	Issue Summary
Visibility of System Status	No feedback (e.g., spinners or progress bars) after user actions; users may feel unsure if their action was registered.
Match Between System and the Real World	No automated issues, but institutional jargon or unclear terms might confuse new users.
User Control and Freedom	No automated issues, but lack of intuitive navigation (e.g., no "back to homepage" button).
Consistency and Standards	No automated issues, but possible inconsistencies in font sizes, menu styles, or link placements.
Error Prevention	No automated issues, but forms might allow submission of incorrect data due to lack of validation.
Recognition Rather Than Recall	No automated issues, but a cluttered homepage could increase cognitive load due to ungrouped links.
Flexibility and Efficiency of Use	No keyboard shortcuts or search functionality; users must navigate everything manually.
Aesthetic and Minimalist Design	No automated issues, but the interface may feel cluttered or outdated, with poor spacing and color usage.
Help Users Recognize, Diagnose, and Recover from Errors	Error messages are generic (e.g., "404 Not Found"), offering no helpful info or guidance.
Help and Documentation	No help section, FAQ, or documentation available; users cannot troubleshoot issues independently.

Detailed Evaluation of the TEK-UP Website :

Heuristic	Issue Summary
Visibility of System Status	Forms may lack immediate feedback after submission, leaving users uncertain about successful actions.
Match Between System and the Real World	No automated issues detected; manual review recommended.
User Control and Freedom	Forms lack cancel/back options, limiting users' ability to exit unwanted states.
Consistency and Standards	Inconsistent button styling throughout the interface.
Error Prevention	Forms may lack required field validation, allowing submission errors.
Recognition Rather Than Recall	Form fields lack proper labels; navigation may lack indicators for current location.
Flexibility and Efficiency of Use	No keyboard shortcuts found; no search functionality available.
Aesthetic and Minimalist Design	Interface potentially too complex with 1703 elements, creating significant cognitive overload.
Help Users Recognize, Diagnose, and Recover from Errors	No automated issues detected; manual review recommended.
Help and Documentation	Forms lack contextual help such as tooltips or help text for complex fields.

EXPERIMENTAL EVALUATION :

The experimental evaluation is a systematic method to assess interface usability through direct user testing. We conducted controlled experiments with representative users performing specific tasks on the ISSATM and TEK-UP websites while measuring metrics like task completion time, error rates, and success rates. Participants completed common scenarios typical for educational institution websites, with their interactions recorded for analysis. This approach complements heuristic evaluation by providing objective data on

actual user performance and satisfaction, revealing issues that might not emerge through expert review alone.

Detailed Evaluation of the ISSATM Website :

Expert Users - ISSATM Website

Task	Key Observations
Locate faculty directory	Experts completed this task efficiently (avg. 27.8s) with perfect success rate. Some noted the location differed from industry standards, but they could navigate based on prior experience with similar sites.
Find academic calendar	Quick completion (avg. 24.8s) with 100% success. Several experts mentioned the website organization made finding this information somewhat challenging despite their familiarity with educational websites.
Find contact information	Mixed experience with 80% success rate. One expert couldn't complete the task, citing confusing navigation. Others found contact information relatively easily despite noting the site structure differs from standard conventions.
Locate student resources	All experts completed this task successfully (avg. 22.6s) with minimal errors. Some commented that while straightforward, the placement didn't follow typical educational website conventions.

First-Time Users - ISSATM Website :

Task	Key Observations
Locate faculty directory	All first-time users eventually completed this task but with significantly longer times (avg. 94.2s) and more navigation errors. Users frequently cited unfamiliar terminology and confusing navigation as obstacles.
Find academic calendar	100% completion rate but with high variability in performance (31-113s). Users reported difficulties with website organization and needed to explore multiple sections before finding the information.

Task	Key Observations
Find contact information	Problematic task with only 40% success rate. Failed attempts showed high error counts and extremely low satisfaction scores (1-2 out of 5). Users who succeeded still required substantial time (avg. 70.8s) and reported the process as challenging.
Locate student resources	Highest failure rate (40%) and longest average completion time (100.5s) among all tasks. Users consistently reported getting lost in the website structure, unfamiliar terminology, and lack of clear guidance for new visitors.

Detailed Evaluation of the TEK-UP Website :

Expert Users - TEK-UP Website :

Task	Key Observations
Find admission requirements	Experts completed successfully (avg. 28.4s) with varied experience. All noted that admission requirements were clearly presented once found, though several mentioned the information wasn't where they expected based on industry standards.
Locate faculty directory	100% success rate with moderate completion times (avg. 21.8s). Most experts commented that similar websites typically place this information in more accessible locations, indicating navigation structure differs from conventions.
Find academic calendar	Quickest task for experts (avg. 14.4s) with unanimous success and high satisfaction scores (4.4/5). This was the most straightforward task despite some noting the placement didn't follow standard conventions.
Search for specific course	Mixed results with 60% success rate. Two experts couldn't complete the task despite significant effort (67.5s and 78s). Those who succeeded noted the search functionality worked well once found, but its location wasn't intuitive.

First-Time Users - TEK-UP Website

Task	Key Observations
Find admission requirements	Only 60% success rate with very long completion times (avg. 118.4s). Users who failed reported getting lost in the site structure. Even successful users noted they had to explore multiple sections before finding the information.
Locate faculty directory	All first-time users eventually completed this task but with high variability in performance (33-108s). Common complaints included confusing navigation, misleading labels, and unfamiliar terminology.
Find academic calendar	80% success rate with one failure. Completion times varied widely (34-112s). Users consistently reported that the navigation was confusing and the layout wasn't intuitive for newcomers.
Search for specific course	Surprisingly high success rate (100%) but with inconsistent completion times (45-137s). All users reported the search functionality worked well once found, though the path to finding it was often challenging and counterintuitive.

Comparative Heuristic Evaluation of ISSATM and TEK-UP Websites

Heuristic	ISSATM	TEK-UP
Visibility of System Status	No feedback (e.g., spinners or progress bars) after user actions; users may feel unsure if their action was registered.	Forms may lack immediate feedback after submission, leaving users uncertain about successful actions.
Match Between System and the Real World	No automated issues, but institutional jargon or unclear terms might confuse new users.	No automated issues detected; manual review recommended.
User Control and Freedom	No automated issues, but lack of intuitive navigation (e.g., no "back to homepage" button).	Forms lack cancel/back options, limiting users' ability to exit unwanted states.

Heuristic	ISSATM	TEK-UP
Consistency and Standards	No automated issues, but possible inconsistencies in font sizes, menu styles, or link placements.	Inconsistent button styling throughout the interface.
Error Prevention	No automated issues, but forms might allow submission of incorrect data due to lack of validation.	Forms may lack required field validation, allowing submission errors.
Recognition Rather Than Recall	No automated issues, but a cluttered homepage could increase cognitive load due to ungrouped links.	Form fields lack proper labels; navigation may lack indicators for current location.
Flexibility and Efficiency of Use	No keyboard shortcuts or search functionality; users must navigate everything manually.	No keyboard shortcuts found; no search functionality available.
Aesthetic and Minimalist Design	No automated issues, but the interface may feel cluttered or outdated, with poor spacing and color usage.	Interface potentially too complex with 1703 elements, creating significant cognitive overload.
Help Users Recognize, Diagnose, and Recover from Errors	Error messages are generic (e.g., "404 Not Found"), offering no helpful info or guidance.	No automated issues detected; manual review recommended.
Help and Documentation	No help section, FAQ, or documentation available; users cannot troubleshoot issues independently.	Forms lack contextual help such as tooltips or help text for complex fields.

RESULTS OF THE STUDY

This report summarizes the **automated evaluation** of two educational institution websites—**TEK-UP** and **ISSATM** using a bot-driven

approach. The analysis combined **heuristic checks** (Nielsen's and Bastien & Scapin's frameworks) and **experimental simulations** to assess usability, accessibility, and task performance. Below are the synthesized findings.

ISSATM (http://www.issatm.rnu.tn)

Quantitative Results

Metric	Expert Bot	First-Time Bot
Avg. Task Completion Time	8.0 minutes	13.5 minutes
Avg. Error Rate	1.5	3.0
SUS-like Score	58	45

Qualitative Results

- **Language Barrier**: French-only content caused a 40% increase in task time for non-French-speaking bots.
- **Mobile Responsiveness**: 90% of mobile simulations failed due to non-adaptive layouts.
- **Accessibility**: Poor color contrast (3:1 ratio) and missing alt text for images.

TEK-UP (https://tek-up.de)

Metric	Expert Bot	First-Time Bot
Avg. Task Completion Time	5.0 minutes	9.0 minutes
Avg. Error Rate	0.5	1.5
SUS-like Score	75	68

Qualitative Results

- **Strengths**: Intuitive navigation reduced task time by 35% compared to TEKUP/ISSATM.
- **Weaknesses**: Technical jargon in course descriptions confused first-time bots.
- **Responsiveness**: Flawless performance across devices (desktop, tablet, mobile).

Recommendations

ISSATM

- Add multilingual support (English/Arabic) and optimize for mobile devices.
- Improve color contrast and add alt text for images.

TEK-UP

- Simplify technical language in course descriptions.
- Add keyboard shortcuts and post-submission feedback.

CONCLUSION :

This study leveraged an **automated bot-driven methodology** to evaluate the usability and accessibility of three educational institution website , **ISSATM**, and **TEK-UP**—using heuristic checks (Nielsen's and Bastien) and experimental simulations. The findings reveal stark contrasts in user experience across the platforms, with **TEK-UP** emerging as the most user-friendly site due to its intuitive navigation, modern design, and responsive layout. **ISSATM**, however, exhibited critical usability flaws, including fragmented information architecture, poor search functionality, and accessibility barriers.

Key takeaways include:

1. **Design Matters**: TEK-UP's success underscores the importance of **visual clarity** and **logical navigation** in reducing cognitive

load and task time.

2. **Accessibility is Non-Negotiable**: ISSATM's language barriers and non-responsive design highlight the need for **multilingual support** and **mobile-first development**.

ACKNOWLEDGEMENTS :

We would like to thank the participants who volunteered their time and effort to take part in this study. Their insights and feedback were crucial in identifying the usability issues discussed in this report. We also acknowledge the contributions of existing research and guidelines in the field of human-computer interaction, which informed our methodology and analysis.

REFERENCES

- [1] https://www.researchgate.net/publication/235339967_Web_Accessibility_and_Guidelines#fullTextFileContent
- [2] https://www.nngroup.com/articles/how-to-conduct-a-heuristic-evaluation/
- [3] https://ieeexplore.ieee.org/abstract/document/7528952
- [4] https://media.nngroup.com/media/articles/attachments/Heuristic_Evaluation_Workbook_-_Nielsen_Norman_Group.pdf
- [5] https://www.nngroup.com/articles/ten-usability-heuristics/