

Heuristic Evaluation of the Sport Analysis Application Interface Evaluación heurística de la interfaz de la aplicación de análisis deportivo

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Abstract. This study applied Nielsen's heuristics to assess the user interface of the Sport Analysis Application. The purpose of this application aided students in evaluating their performance based on the test results and adhering to the training guidelines derived from the application's recommendations. The primary framework used in this investigation is Nielsen's heuristics, coupled with experiments to gauge the extent to which the application's user interface aligns with user preferences (user-friendly). The study targeted a population of students, with a sample size of 100 individuals. Analysis and discussion were conducted through the distribution of questionnaires to participants. The research findings revealed that the Visibility of System Status score reached 151. Overall, the study concludes that the developed Sport Analysis Application successfully achieves its primary objectives with a user-friendly interface.

Key Word: Technology, Heuristic, Sport Analysis Application

Resumen. Este estudio aplicó la heurística de Nielsen para evaluar la interfaz de usuario de la aplicación de análisis deportivo. El propósito de esta aplicación es ayudar a los estudiantes a evaluar su desempeño en función de los resultados de las pruebas y cumplir con las pautas de capacitación derivadas de las recomendaciones de la aplicación. El marco principal utilizado en esta investigación es la heurística de Nielsen, junto con experimentos para medir hasta qué punto la interfaz de usuario de la aplicación se alinea con las preferencias del usuario (fácil de usar). El estudio se dirigió a una población de estudiantes, con un tamaño de muestra de 100 individuos. El análisis y la discusión se llevaron a cabo mediante la distribución de cuestionarios a los participantes. Los resultados de la investigación revelaron que la puntuación de visibilidad del estado del sistema alcanzó 151. En general, el estudio concluye que la aplicación de análisis deportivo desarrollada logra con éxito sus objetivos principales con una interfaz fácil de usar.

Palabra clave: tecnología, heurística, aplicación de análisis deportivo.

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Introduction

User Interface (UI) stands as a technological advancement leveraging digital and internet technologies to design products with the goal of enhancing comfort and ease of use. UI serves as a critical visual communication factor influencing the success of an application (Aylward et al., 2022; Bunian et al., 2021; Dwivedi et al., 2022). UI encompasses the visual aspects directly observable in an application, including layout or design. The creation of a sample design holds significance in the UI design process (Rauschnabel et al., 2022; Swearngin et al., 2018). UI design involves crafting a visually appealing combination of colors, shapes, and typography layout. UI designers typically seek and create design repositories to inspire new ideas and select viable design options (Franzò et al., 2023; Herring et al., 2009; Mortati et al., 2023).

User Interface Design, also referred to as UI design, centers on product interaction and presentation. A well-designed UI can create a satisfying experience for users during system use (Botagariyev et al., 2024; Turdaliyev et al., 2024; Xing et al., 2022). Conversely, inefficient design may lead users to struggle in accessing various features and tools within the application interface (Lyngs et al., 2022; Zaina et al., 2022, 2022). Hence, the user interface is an integral component enabling users to access and execute various application functions. The user interface also integrates application elements and user elements, fostering interaction between the two (Engelke, 2020). System designers, programmers, and developers

are expected to create the best possible user interface (UI) aligned with the problem at hand, making information systems user-friendly. The context of the user interface, "user-friendly" implies being "pleasant to use," with the designed system accommodating various languages and utilizing simple language (Kuspanov et al., 2024; Nilsson & Rosenberg, 2022; Ridwan et al., 2023). Furthermore, the application should possess qualities or functions facilitating system operation. Usability is defined as the level of ease of use and the effectiveness of a product in different user-defined goals (Nuraeni et al., 2022; Rusmanto et al., 2023; Umar et al., 2023). Various methods exist to evaluate the application usability, including heuristic evaluation methods (Anuar & Othman, 2022).

The Sport Analysis Application is designed to assist students in assessing their performance based on the test results and adhering to the training guidelines derived from the application's recommendations. The development goal of the Sport Analysis Application (Damrah et al., 2023; Komaini et al., 2022; Septri et al., t.t.) is to enable students (Marheni et al., 2024; Wahyuri et al., 2023) to directly view their performance statistics based on the test results and receive recommendations accordingly (Rifki dkk., 2022). The Sport Analysis Application is currently available in the Sport Science Faculty of Universitas Negeri Padang sports department. It assists students in managing their time and tasks, and facilitates the skill enhancement. Each user has a unique user interface (UI) for each action, much like the entire

system. The system's user interface (UI) dynamically evolves during the system development process.

This study aims to evaluate user satisfaction with the developed system interface and guide developers in assessing the user interface of the Sport Analysis Application. Nielsen's heuristics are employed as a method to design the user interface, focusing on Human-Computer Interface (HCI) principles.

User Interface Design, often referred to as UI design, focuses on the interaction and presentation of a product. A quality UI design can create a satisfying experience for users as they navigate the system. Conversely, if the design is less efficient, users may encounter difficulties accessing various features and tools available in the application interface. Therefore, the user interface is a crucial component in a system that enables users to access and execute various application functions. For example, interaction design integrates more internet service features into the aesthetics of user-focused thinking and interface design, such as incorporating service design methods into the Human-Computer Interface (Höök & Löwgren, 2021).

The User Interface must be designed to be simple and efficient, as evidenced by the consistent arrangement and application of layout elements, typography, color, imagery, and controls, facilitating user understanding. The system should provide clear and informative feedback when users take actions. In conclusion, an interface must be well-designed and "user-friendly" to enhance user usability. Due to the advantages listed above, this method was chosen comprehensively as the primary reference for analyzing the user interface design for the Sport Analysis Application.

The Nielsen's heuristics method used to analyze the interface display in the Sport Analysis Application, created for the Sport Science Faculty of Universitas Negeri Padang sports department, is the core component of this research. This method is used to create a visually appealing user interface while achieving various specific goals. Therefore, when designing the application interface, ten factors must be considered. These ten components have been included in the Sport Analysis Application interface design process through surveys of Sport Science Faculty of Universitas Negeri Padang students. The core questions in this paper are as follows:

1. Visibility of system status

Excessive status information where the application provides too much redundant status information, which can also disrupt users in using the application.

2. Match between system and the real-world

Mismatch between functions and icon symbols in the application.

3. User control and freedom

Lack of buttons to return to the previous page in the application.

4. Consistency and standards

Font, numbers, text, and dates are all in the Indonesian

language.

5. Error prevention

Application performance failure, for example, no confirmation message after the process is complete.

6. Recognition rather than recall

Poor visual feedback and the user guide does not offer useful content in using the application.

7. Flexibility and efficiency of use

Loading or refreshing the page when accessing the application takes too long.

8. Aesthetic and minimalist design

Unattractive design and poor layout in the application.

9. Help users recognize, diagnose, and recover from errors. The inability of the application to cancel entered data in the application.

10. Help and documentation

The application lacks any features related to this principle, as the application already has good documentation.

Method

This research, a methodological framework rooted in Research and Development (R&D) was strategically employed, coupled with a DevOps (Development and Operations) approach (Faiza et.al., 2022). The R&D approach served as the guiding strategy to craft a specialized product tailored to the intricacies of sport science (Amran, 2023; Firdausi et.al., 2023; Shchokin et.al., 2023). This methodology places a strong emphasis on innovation, seeking to create a product that not only meets industry standards but also pushes the boundaries of what is conventionally available.

The integration of the DevOps development model adds another layer of sophistication to the methodology (Amaro et.al., 2023; Cifuentes et.al., 2023; Venanzi et.al., 2023). DevOps promotes collaboration and communication between the development and IT operations teams, fosters a streamlined and efficient workflow (Díaz et.al., 2023). This collaborative approach is particularly beneficial in the context of creating a user interface for a sport science application, where seamless integration of features and functionalities is crucial.

The effectiveness of the developed application's user interface is rigorously assessed using Nielsen's Heuristics (Anuar & Othman, 2022; Sobrino-Duque et.al., 2022). This methodological choice reflects a commitment to robust usability testing and heuristic evaluation. Nielsen's Heuristics, established by Rolf Molich and Jakob Nielsen, provide a set of heuristics or guidelines to evaluate the user interface's usability. The evaluation process with Nielsen's Heuristics serves a dual purpose (Benaida, 2023; Lecaros et.al., 2022). Firstly, it identifies potential issues or deficiencies in the user interface that might impede users from accomplishing their goals effectively. Secondly, it offers actionable insights and recommendations for improvement. This iterative feedback loop is integral to

the development process, ensuring that the user interface evolves in tandem with the dynamic needs of sport science practitioners.

By adopting this research and development strategy, complemented by the DevOps approach and Nielsen's Heuristics, the study aims not only to create a functional product but also to elevate the user experience within the specialized domain of sport science. This comprehensive approach underscores the commitment to advancing the state of the art in sport science applications, with the user interface as a focal point for refinement and enhancement.

Nielsen's heuristics serve as the foundational basis for formulating new rules and guidelines regarding usability (Quiñones & Rusu, 2019). The assessment instrument of Nielsen's heuristics covers various aspects, including Visibility of System Status, Match between system and the real world, User control and freedom, Consistency and standards, Error prevention, Recognition rather than recall, Flexibility and efficiency of use, an aesthetic and minimalist design, as well as Help users recognize, diagnose, and recover from errors. All these rules were created by Rolf Molich and Jakob Nielsen when developing this technique. Subsequently, research was conducted on the Sports Analysis Application, taking into the potential accounts mentioned above.

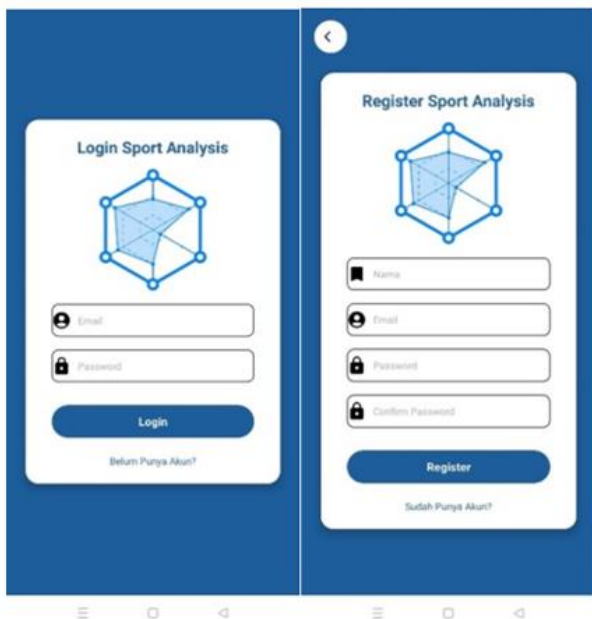
Heuristic evaluation stands as a primary method aimed at identifying interface design-related issues (Alomari et.al., 2020). This method is used to evaluate the user interface, focusing on usability and user-friendliness. In the heuristic evaluation process, an expert or independent evaluator

utilizes a set of evaluation principles, such as Nielsen's heuristics, to identify potential issues in the interface design (Benaida, 2023; Guo et.al., 2023; Othman et.al., 2022). The evaluation results serve as a guide for designers to improve the overall quality of the user interface, providing a better user experience.

Nielsen's heuristics serve as a tool to address various interface design issues (Sobrinu-Duque et.al., 2022). Some heuristics describe specific contexts and examples unrelated to Nielsen's heuristics in this study. This information helps connect relevant heuristics to those specific contexts in several case. Nielsen's heuristics prove beneficial for this purpose through their existing ten heuristics (Chalhoub et.al., 2024; Patel et.al., 2023).

This section focused on the application's appearance in the Sport Analysis Application. This study provides a brief explanation of some features and functions that have been integrated into the application. At the end, it has outlined the variable names and questionnaire results referring to Nielsen's heuristics. Questions for the selected population are thoroughly chosen. The graphical user interface of the Sport Analysis Application has several features. To access the application's main menu, students must go through some authentication procedures, such as entering a username and password. There are several menus on the main page of the Sport Analysis Application, such as Biodata, Kick Speed, General Agility, Hand Muscle Burst, Kick Muscle Burst, Kick Agility, and so on, as seen in Figure 1. Features for students.

a) Login Page and Registration



(b) Student Menu (c) Student Statistic Test



Figure 1. (a) Login Page and Registration; (b) Student Menu; (c) Student Statistic Test

Upon successful login, students will be introduced to the "Student Menu," serving as the primary gateway to various features within the application. The "Student Menu" is meticulously designed to offer easy and organized access to vital information and functions.

Within this menu, students will encounter several options to cater to their needs: Biodata, Kick Speed, General Agility, Hand Muscle Burst, Kick Muscle Burst, and Kick Agility. The "Student Statistic Test" presents

student statistics based on the conducted tests. Analysis findings are succinctly summarized in Table 1. to provide a clear and comprehensible visualization. This table itemizes crucial findings discovered throughout the analysis process, presenting them in a structured format. Through Table I, readers can readily observe the primary analysis results and pertinent information, conveniently categorized and comprehended.

Table 1.
Variable Identification and Questionnaire Data

Rules	Population	Question	Questionnaire Results (Score)				Total	Total Score
			1	2	3	4		
Visibility of system status	Student.1	Status information on the application works well when providing recommendations based on test results.	6	13	54	27	100	151
		Average*Score	3	13	81	54		
Match between the system and the real world	Student.2	Provision of easy-to-understand icon symbols	5	17	47	31	100	152
		Average*Score	2.5	17	70.5	62		
User control and freedom	Student.3	The Back, Undo and Redo icons work well in the app.	3	16	56	25	100	151.5
		Average*Score	1.5	16	84	50		
Consistency and standards	Student.4	Fonts, Numbers, Text and Dates are all in Indonesian	5	12	31	52	100	165
		Average*Score	2.5	12	46.5	104		
Error prevention	Student.5	Response will be done quickly if the application has an error.	7	21	48	24	100	144.5
		Average*Score	3.5	21	72	48		
Recognition rather than recall	Student.6	The use of color composition in the Sport Analysis App is impressive.	3	12	51	34	100	158
		Average*Score	1.5	12	76.5	68		
Flexibility and efficiency of use	Student.7	The application loading process went smoothly.	2	12	61	25	100	154.5
		Average*Score	1	12	91.5	50		
Aesthetic and minimalist design	Student.8	The app has an attractive design and a good layout.	4	11	48	37	100	159
		Average*Score	2	11	72	74		
Help users recognize, diagnose, and recover from errors	Student.9	The application can revise the data that has been entered on the application.	4	7	66	23	100	154
		Average*Score	2	7	99	46		
Help and documentation	Student.10	The application guidebook for students is very easy to understand.	1	8	57	34	100	162
		Average*Score	0.5	8	85.5	68		

Results and Discussion

This section details the results of the user interface analysis and discussion regarding the Sport Analysis Application. Students majoring in sports science at the Sport Science Faculty of Universitas Negeri Padang provided data as respondents. Ten variables were included in the survey given to the students. In Table I, there is an Identification of Variables and Questionnaire Data. Sample selection was carried out using the Systematic Random Sampling method (Bhardwaj, 2019), involving regular sampling at specified intervals from the sorted sample frame or selecting specific individuals and members from the entire population.

A total of 100 students participated as respondents in this study. It was carefully selected questions that were relevant to each variable for both lecturers and students. Additionally, this study used a scale from 1 to 4 for the questionnaire results. By calculating the average values from the students, it could assign an overall score for each variable. Subsequently, these total scores were analyzed to obtain feedback from the users. In Table I, the

identification of variables used (in accordance with Heuristic evaluation) and questionnaire data is presented. The Likert scale was employed to calculate the values for each variable by presenting a series of statements related to the researched topic (Chehore, 2022). The Likert scale measures users' perspectives on a matter by asking them to indicate their level of agreement or disagreement with specific statements. A score distribution was created to evaluate how respondents assessed the application and generate an acceptance scale. The score ranges used are as follows:

Lowest Score = (Number of Respondents x Minimum Score) = 50 x 1 = 50

Highest Score = (Number of Respondents x Maximum Score) = 50 x 4 = 200

The following value categories are created by the authors:

Poor: 50 up to 80

Not good: 81 up to 110

Acceptable: 111 up to 140

Good: 141 up to 170

Excellence: 171 up to 200

The methodology presented outlines a structured way for quantitatively analyzing the comments from

respondents within a research context. At first, the lowest possible score is calculated by multiplying the total number of respondents by the smallest recorded score. Similarly, the maximum attainable score is calculated by multiplying the total number of respondents by the highest score recorded. Afterwards, the author establishes a hierarchical system of value categories to divide the range of scores into several tiers. These tiers consist of five categories: "poor," "not good," "acceptable," "good," and "excellent," each defined by a certain range of scores. For example, the category "poor" represents scores between 50 and 80, whereas the category "excellent" includes scores between 170 and 200. This paradigm enables the unbiased assessment and categorization of respondent comments, hence improving the clarity and practicality of research findings within a scientific environment.

Based on the findings of the user analysis of the Sport Analysis Application using Nielsen's heuristics method, it can be inferred that respondents have confidence that the proposed application is adequate. A summary of these findings can be explained as follows:

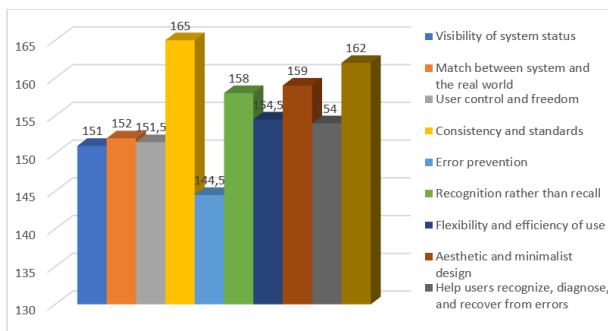


Figure 2. Results of Nielsen's Heuristics Analysis

Visibility of System Status (Score: 151):

It is recommended to replace the existing guide page with a more concise and lucid version, ensuring users can easily comprehend and navigate through the system in optimizing the application's user guide.

Match Between System and the Real World (Score: 152):

It is advised to incorporate easily interpretable icon symbols that effectively convey information about the functionality of each menu, aligning the application with real-world concepts to enhance user understanding.

User Control and Freedom (Score: 151.5):

Specifying icons for Back, Undo, and Redo is crucial to facilitate smooth functionality, taking into consideration potential user navigation preferences and ensuring a sense of control for a user-friendly experience.

Consistency and Standards (Score: 165):

It is imperative to consistently employ the Indonesian language throughout the application, adhering to established standards for linguistic coherence to maintain a seamless user experience.

Error Prevention (Score: 144.5):

Two key recommendations are proposed: firstly, promptly display completion notifications following the data input process, and secondly, enhance the application's responsiveness to user errors, ensuring a more error-resistant environment in preventing errors.

Recognition Rather Than Recall (Score: 158):

The application should be designed with appropriate visual feedback, coupled with leveraging the impressive use of color composition within the Sport Analysis Application to minimize cognitive load.

Flexibility and Efficiency of Use (Score: 154.5):

It is essential to ensure smooth loading processes, guaranteeing quick and hassle-free access to the application's features for an efficient user experience.

Aesthetic and Minimalist Design (Score: 159):

It is recommended to create an attractive design with a well-thought-out layout, utilizing contrasting colors and appropriate fonts for a minimalist yet captivating design to enhance visual appeal.

Help Users Recognize, Diagnose, and Recover from Errors (Score: 154):

Practical recommendations include implementing the application's capability to cancel or revise entered data and providing a clear data correction process post-initial confirmation, facilitating user recognition and recovery from errors.

Help and Documentation (Score: 162):

Introduce a comprehensive user guide explaining intricate aspects of the application. For optimal accessibility, compile the guide into a single document, ensuring a seamless and user-friendly experience to empower users.

It could be concluded that this application has successfully created an effective interface, serving as a bridge between users and design, providing comfort and satisfaction based on these findings. The designed application interface, aligned with student capabilities and recommendations, resulted in a satisfactory outcome during heuristic evaluations (Kuhail et.al., 2023; Roscoe & Craig, 2022). It is essential to note that various aspects of the user interface have undergone rigorous examination using diverse methods and techniques.

Conclusions

This study employed Nielsen's heuristics to assess various key components of the user interface developed for the Sport Analysis Application. According to feedback from respondents, our user interface design was deemed sufficiently effective for real-life use, with scores ranging from a minimum of 50 to a maximum of 200. It was observed that Nielsen's heuristics proved to be a suitable

approach for this research, as its principles could be applied to the study's topic. Like any set of rules, each option has its advantages and disadvantages. In future endeavors, it needs to be considering adding more features to be evaluated using different methodologies. Designing a user interface model becomes more intricate as application features grow in complexity. Moreover, a user interface with robust functionality may receive diverse comments from users. In summary, case studies involving various features and methodologies are still open for exploration and review. As a final step, special attention is needed during the evaluation of this application in the early stages of design and development to encounter fewer issues during implementation.

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