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Usability Evaluation of Learning Management System (LMS) Interface Universitas Pakuan Mobile Version With Heuristic Walkthrough Method

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Abstract

This study aims to evaluate the usability of the mobile Learning Management System (LMS) interface at Universitas Pakuan using the Heuristic Walkthrough method. This method combines Heuristic Evaluation and Cognitive Walkthrough to systematically identify usability problems and assess their severity. Major usability issues were observed in navigation, search functionality, interface consistency, and user guidance, with an average severity rating of 2.72 for Heuristic Evaluation and 2.02 for Cognitive Walkthrough, indicating significant problems. A prototype was developed using the Goal-Directed Design approach, focusing on enhancing navigation, consistency, and functionality. Post-trial evaluation revealed a substantial reduction in severity rating to 0.17, highlighting only minor cosmetic issues. These findings underscore the effectiveness of the proposed approach in improving LMS usability. However, further research is recommended to refine responsive design and explore features beyond the current scope of evaluation.

Keywords: *Usability; Heuristic Walkthrough; LMS; Goal Directed Design*

1. Introduction

Learning Management System (LMS) is software used for administration, documentation, reporting, automation, and delivery of an online learning process [1]. In the use of LMS at Universitas Pakuan, the usability [2] aspect of the mobile display uses Heuristic Walkthrough (HW) [3] method which according to Sears, in [4] is combined method of Heuristic Evaluation and Cognitive Walkthrough produces more valid and thorough data than Heuristic Evaluation and Cognitive Walkthrough.

Previous research related to Heuristic Walkthrough method conducted [5] found 29 problems in finding buttons and 20 consistency and standard problems as heuristic principles which had the highest percentage, namely 30% of all problems found on the Medizi website interface. According to [6] evaluated the usability of the XYZ scholarship website using the Heuristic Walkthrough method, identifying 102 issues through Cognitive Walkthrough, with feedback contributing to 30.4% of problems detected by novice, expert, and double-expert evaluators. Additionally, 20 heuristic issues (22.2% of total findings) were identified, primarily related to "match between system and the real world" and "flexibility and efficiency of use." Similarly, [7] reported 54 usability issues using the Heuristic Walkthrough method, comprising 33 issues from Cognitive Walkthrough and 21 from Heuristic Evaluation, with an average severity rating of 13.4.

Conducted a comparative usability study of Moodle and Edmodo at SMKN 8 Malang, finding 15 issues in Moodle and seven in Edmodo through Cognitive Walkthrough, as well as 16 heuristic issues in Moodle and 15 in Edmodo [8]. In a related study, [9] compared the usability of Edmodo and Google Classroom at SMKN 11 Malang using the Heuristic Walkthrough method. They identified 14 issues in Edmodo and 20 in Google Classroom through Cognitive Walkthrough, along with 23 heuristic issues in Edmodo and nine in Google Classroom through Heuristic Evaluation.

This study aims to identify obstacles and there has been no evaluation of the effectiveness of using HW method on LMS of Universitas Pakuan. The scope of this study is aimed at Universitas Pakuan students in the evaluation of the Mobile version of the LMS and is developed in the form of a design prototype.

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2. Research Methods

This research was conducted using Heuristic Walkthrough method, a combination of Cognitive Walkthrough and Heuristic Evaluation to determine the problems in the responsive mobile LMSdisplay of Universitas Pakuan and developed using the Goal-Directed Design method. Figure 1 shows the flow of the research carried out.

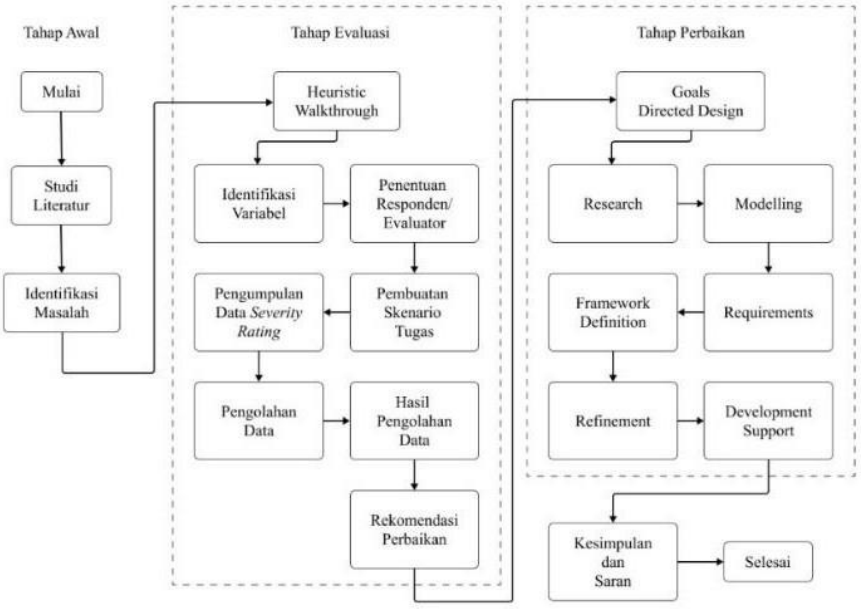

Figure 1. Research Flow

2.1. Literature Study

The purpose of the literature study is to deepen understanding related to concepts such as Usability, Heuristic Walkthrough, Heuristic Evaluation, Cognitive Walkthrough, Severity Rating,Prototype and Goal Directed Design.

2.2. Identification Problem

Testing the effectiveness of LMS users and interfaces using the Heuristic Walkthrough approach to identify problems carried out by the evaluatior.

2.3. Heurtistic Walkthrough

Cognitive Walkthrough is the initial step Heuristic Walkthrough evaluation process, where the evaluator completes a series of evaluation tasks in a specific order. In carrying out this task, a number of task scenarios are submitted to help the user identify potential problems. Heuristic Evaluation is the next phase in Heuristic Walkthrough series. Heuristic Evaluation begins with the evaluator thoroughly inspecting the system interface, compare it with Nielsen's heuristic principles [10][11]. In this step evaluator provides an assessment for each problem finding based on Severity Rating [12].

2.4. Variable Identification

The variables used are in the form on a task scenario (ST) design evaluation that has been determined from features that are frequently used by users, Heuristic Evaluation based on heuristic numbers such as clarity of error messages and design consistency, which will be used asa guideline in compiling variables.

2.5. Determining the Respondent or Evaluator

Evaluators are divided into three categories, namely evaluators with experience as LMS users, evaluators with special expertise and evaluators with special expertise and experience with similar case studies. The evaluator selection criteria can be found in Table 1 by referring to the research conducted [13].

Table 1. Evaluator Categories and Characteristics

Kategori	Karakterisik Evaluator
Novice	Have no background in Usability Expertise
Expert	Have a background in expertise as a usability expert oruser experience and user interface
Double-Expert	Has usability expert background and experience inevaluating similar interface.

In qualitative research studies to obtain significant result and speed up the process usability there are 10 evaluators or respondents in Table 2 based on Nielsens's statement [14].

Table 2. Respondents of Heuristic Walkthrough

No.	Name	Category	Work
1.	Arkan Tanriwa	Double-Expert	Employee
2.	Dede Alsa	Double-Expert	Employee
3.	Erry Tri Putra	Expert	Employee
4.	Pandi Atuk Setiayanasa	Expert	Employee
5.	Teja Salangka Dermawan	Expert	Employee
6.	Reyhan Pridyanandha H	Novice	Student
7.	Mulyati	Novice	Student
8.	Ananda Dea Fitria	Novice	Student
9.	Muhammad Farid Fadhlan	Novice	Student
10.	Abdul Azis Al-Gifari	Novice	Student

2.6. Creating Task Scenario

The task scenario is based on heuristic numbers and the use of features that are often useb by LMS users, such as searching and registering for classes, searching for course materials and assignments, uploading documents, searching for grades and editing profiles. For Heuristic Evaluation, only a few heuristic numbers are used, such as visibility and system status (H-1), usercontrol and freedom (H-3), consistency and standards (H-4), recognizing rather than remembering the system (H-6), user flexibility and efficiency (H-7) and user assistance inrecognizing, diagnosing, and correcting errors (H-9).

In the Cognitive Walkthrough data collection, respondents will be given a task scenario in Table 3 which respondents must work on to find problems with thought-provoking in the system.

Table 3. Cognitive Walkthrough Task Scenario

Kode Tugas	Tujuan	Langkah
ST1	Masuk dengan email dan password	2
ST2	Mencari kelas sesuai mata kuliah	7
ST3	Mendaftar kelas sesuai mata kuliah	2
ST4	Mencari materi mata kuliah	2
Kode Tugas	**Tujuan**	**Langkah**
ST5	Mencari tugas mata kuliah	3
ST6	Mengunggah dokumen tugas mata kuliah	2

ST7	Menghapus dokumen pada private files	2
ST8	Mencari nilai tugas mata kuliah	2
ST9	Mengedit profile pribadi	3

The respondent's task at the Heuristic Evaluation step will use 6 usability aspect numbers containing 14 statements related to heuristics based on Nielsen's Heuristic Evaluation in Table 4.

Table 4. Aspect Heuristic Evaluation Nielsen's

Heuristic Number	Apsek Heuristic Evaluation	Statement
H-1	Visibility and Status System	• The design communicates the condition clearly. • Feedback is presented quickly after the user action.
H-3	User Control and Freedom	• The design allows users to take a step back inthe process. • The exit button is easy to find. • Users can easily undo an action. • Undo and Redo are supported.
H-4	Consistency and Standards	• The design follows industry standards. • Display components are used consistently throughout the design.
H-6	Recognition Without Remembering System	• Design keeps important information visible so users don't have to memorize it. • Design offers help in context.
H-7	User Flexibility and Efficiency	• Design provides shortcuts for Classes/Assignments. Content and functions are personalized or customized for each user.
H-9	User Help Recognizing, Diagnosing, and Repairing Errors	• Designs use traditional or technical error message visuals, such as bold red text. • Designs offer solutions that can resolve errors immediately.

2.7. Severity Rating Data Collection

The severity rating data or score is determined by the evaluator or respondent if a problem is found, the severity rating score given refers to Table 1. In addition to giving a score, the evaluatoris asked to provide notes. Task Scenario 1 Figure 2. is taken as a sample in collecting severity rating data, Task Scenario 1 where testing is carried out on the main LMS display to log in to the LMS using the provided Email and Password.

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Figure 2. Display of Task 1 Scenario

The data obtained in Table 5 from Task Scenario 1. C is annotated as the Cognitive WalkthoughTask Scenario step and R is annotated as the Respondent.

Table 5. Task Scenario Data Sample

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
C1	0	0	0	1	1	0	0	0	1	1
C2	1	2	2	0	2	0	0	0	0	1
	1	2	2	1	3	0	0	0	1	2

Heuristic Evaluation data collection based on respondent analysis of previous task scenarios. H is annotated as a statement in the heuristic number and R is annotated as a respondent in Table 6.

Table 6. Severity Rating Heuristic Evaluation Data

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
H1	2	3	3	2	4	4	4	3	1	3
H2	0	0	2	4	3	4	4	4	1	1
H3	0	4	4	3	3	4	4	4	2	0
H4	1	1	2	4	4	4	4	4	3	2
H5	2	3	2	4	4	1	2	2	2	2
H6	2	4	3	2	2	4	4	4	3	4
H7	3	1	1	4	4	3	3	3	3	3
H8	3	1	0	4	4	4	4	4	4	0
H9	2	4	4	4	4	4	4	4	3	4
H10	3	4	4	4	4	3	4	4	3	1
H11	0	1	1	4	4	4	4	4	4	2

H12	2	1	1	4	4	2	1	2	2	3
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
H13	1	1	1	2	2	1	1	1	1	2
H14	0	3	3	0	0	4	4	4	4	3
	21	**31**	**31**	**45**	**46**	**46**	**47**	**48**	**36**	**30**

2.8. Data processing

The data obtained from respondents will be processed and the average value will be sought to determine the severity value. The average severity value refers to the mean rating in Table 1.

$$x = \frac{\sum x}{n} \quad (1)$$

Annotation:
x = Mean Severity Rating
$\sum x$ = Total *Severity Rating*
n = Number of Frequency

Evaluation results are calculated based on the variants used, where aspects that have a severity rating score of more than 0 are counted as 1 problem finding. Percentage of errors is calculated by dividing the number of problems found by respondents in all aspects of Heuristic Evaluation or Cognitive Walkthrough task scenarios found by the total number of aspects or task scenarios.

$$Persentase\ Kesalahan = \frac{Jumlah\ \ Temuan\ Masalah\ HE\ atau\ CW}{Jumlah\ Aspek\ \ HE\ atau\ CW\ x\ Responden} * 100\%$$

2.9. Results of Data Processing

From data has been collected after calculating average severity rating of each respondent for the steps in the task scenario regarding the Heuristic Walkthrough. Average data of the task scenario was made which was annotated as ST for each respondent. Results of Cognitive Walkthrough calculation are in Table 7.

Table 7. Cognitive Walkthrough Task Scenario Calculation Result Data

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Mean
ST1	0,50	1	1	0,50	1,50	0	0	0	0,50	1	0,6
ST2	4	2,86	2,14	2,28	2,28	0,86	1	1	4	4	2,44
ST3	1	1.5	2	3	3	1	1	1	1,50	2,50	1,78
ST4	1	4	4	4	4	4	4	4	3	2,5	3,45
ST5	0,67	3	3	3,33	3,33	2	3	2	2,33	2,33	2,49
ST6	1	1	1	3	4	1	0	1,50	1,5	1,5	1,55
ST7	1	1	1	4	4	0,50	0,50	0,50	2,50	2,50	1,75
ST8	0	1	1	3,50	3,50	2	2	2	2,50	2,50	2
ST9	1,33	1,33	1,33	3,67	3,33	2,33	1,67	2	2,67	3,33	2,29
	10,5	15,1	16,4	27,2	28,9	13,6	13,1	14	20,5	22,2	

From task scenario data, Average severity rating on Cognitive Walkthrough for each respondentis calculated to be measured by severity rating on Heuristic Evaluation. HE is annotated as the average severity rating of Heuristic Evaluation and CW is annotated as average severity rating of Cognitive Walkthrough given by the respondents. Results of Heuristic Walkthrough Evaluation shown in Table 8.

Table 8. LMS Heuristic Walkthrough Evaluation Results

	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	Mean
HE	1,50	2,21	2,21	3,21	3,29	3,29	3,36	3,42	2,57	2,14	2,72
CW	1,17	1,69	1,83	3,03	3,21	1,52	1,47	1,55	2,27	2,46	2,02

Results evaluation was carried out to determine the percentage of errors that are often found in Cognitive Walkthrough and Heuristic Evaluation. Findings of HE problems on the number of HEaspects and findings of CW problems on the number of CW task scenarios by all respondents.

$$Persentase\ Kesalahan\ HE\ = \frac{130}{140} * 100\% = 0{,}928 * 100\% = 92{,}8\%$$

The percentage of problems found in heuristic evaluation was 92.8%, result of calculations fromall respondents.

$$Persentase\ Kesalahan\ CW\ = \frac{86}{90} * 100\% = 0{,}955 * 100\% = 95{,}5\%$$

The percentage of problems found in cognitive walkthrough was 95.5%, result of calculationsfrom all respondents.

Evaluation results show the need for improvements to LMS from Heuristic Evaluation and Cognitive Walkthrough aspects.

2.10. System Repair Recommendations

Recommendations for improvement in form of designs and prototypes of improvements in Goal Directed Design step based on results of the data that has been obtained.

2.11. Goal Directed Design

Goal Directed Design (GDD) is a step used in design improvement because it meets the needs orgoals of the organization as well as the goals of the users [15] .

2.12. Research

Identify the audience and understand user needs, use data to meet user needs, goals and references and analyze related industry trends. Notes are collected and grouped based on problempriorities and summarized in Figure 3 for the next step.

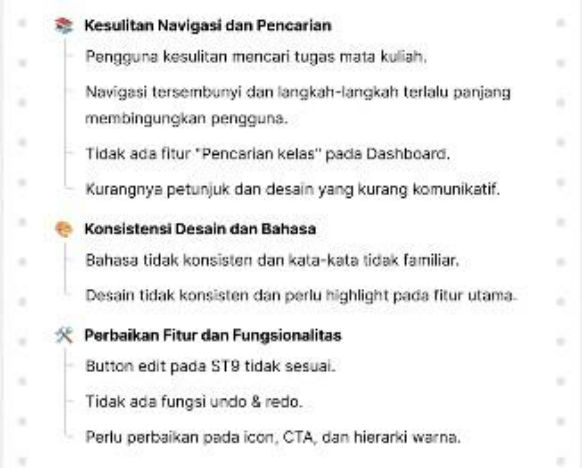

Figure 3. Summary of Problem Notes

2.13. Modelling and Requirements

Conceptualization to understand the context and relationships between elements and create user flows to clearly represent user information and determine user needs and improvement goals and identify the functions and features needed to meet user needs. User Flows are shown in Figure 4.

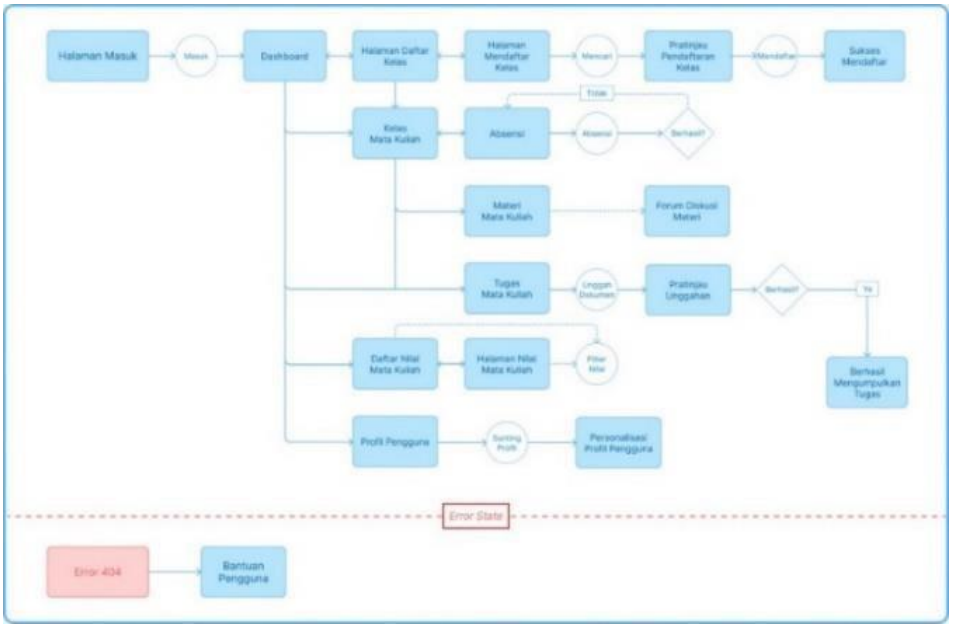

Figure 4. User Flows Recommendations for Improvement

2.14. Framework Definition & Refinement

Building a basic framework of improvement solutions in design and determining information architecture and navigation. Iterating on improvements based on feedback from users or stakeholders in this context the stakeholders are PUTIK Pakuan University. High-Fidelity or the finished design form is in Figure 5.

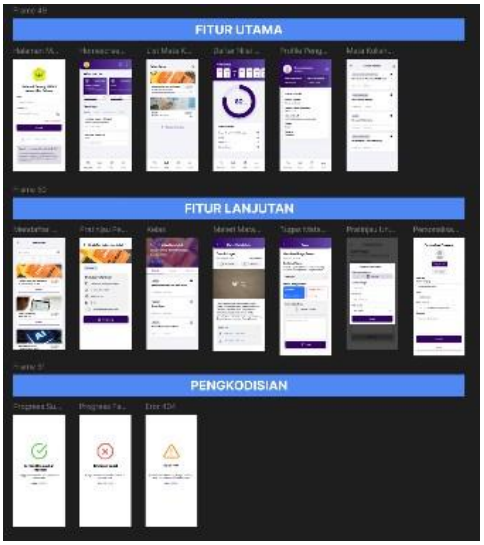

Figure 5. High Fidelity Recommendations for Improvement

2.15. Development Support

Supports development based on needs and creates prototypes to create an overview for developers. Prototype flow to help facilitate application development and provide an overview ofhow features work as in Figure 6.

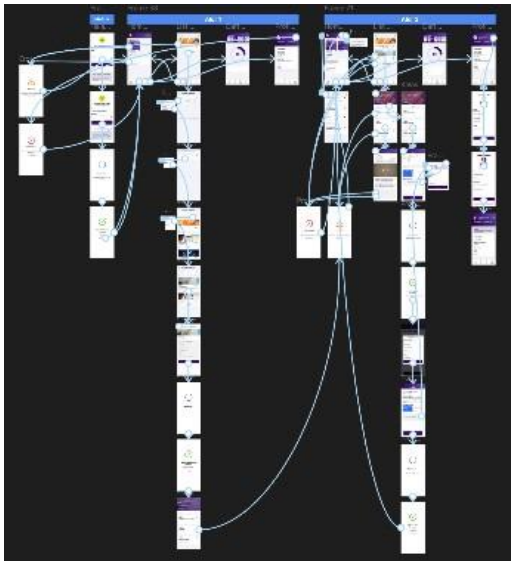

Figure 6. Prototype Flow Recommendations for Improvement

3. Result and Discussion

Improvements based on problem findings from respondent notes, such as difficulties in navigation and searching, consistency of design and language, and improvements to features and functionality, for more details see Figure 3.

3.1. Navigation and Search

a. Users have difficulty finding course assignments
   Course assignments are displayed on the initial display so that users can access them effectively.
b. Hidden navigation and steps are too long and confuse users
   Navigation is made simpler and displays some of the main features of the LMS.
c. There is no class search feature on the Dashboard
   Search feature added to "Kelas" navigation and also when registering or adding new class, additional filtering feature based on faculty, study program and semester to be able to filter based on user's condition.
d. Lack of instructions and less communicative design
   The instructions given are appropriate but the design is not very striking. In order to get theuser's attention, the design is made as attractive as possible.

3.2. Design and Language Consistency

a. Inconsistent and Unfamiliar Language
   Overall, the language in the design has been adapted to Indonesian.
b. Design is inconsistent and needs to highlight key features
   Overall the design has been adjusted in terms of color consistency, fonts and also buttons and text filling forms.

3.3. Feature and Functionality Improvements

a. The edit button in Task Scenario 9 is not correct. In the old display, the edit button did not conform to the general standard so it could confuseusers. In the new display, the edit button is adjusted to a more familiar icon shape as shown in Figure 7.

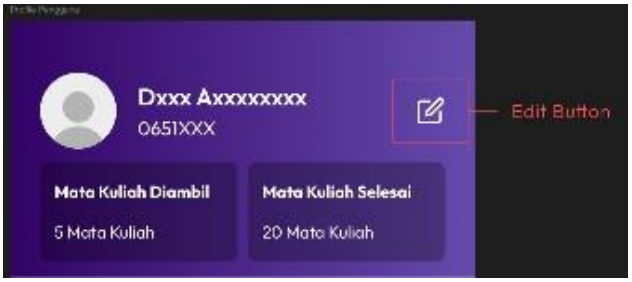

Figure 7. Profile View After Repair

b. There is no undo and redo function
   The undo and redo functions cannot be implemented in the design.
c. Needs improvement on icons, CTAs, and color hierarchy

Figure 8. Documentation of Icon Use

The icon has been adjusted so that users can understand the shape of the icon and itsfunction as in Figure 8.

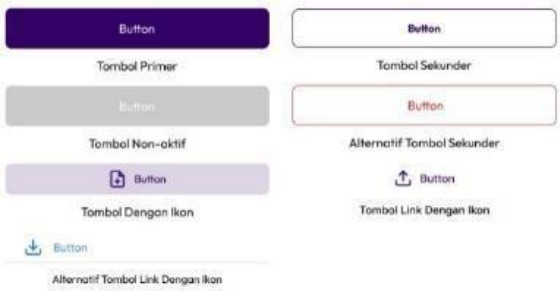

Figure 9. CTA Documentation

The CTA or button improvements have been adjusted to their function and the conditioning of the application design. Explanation of the use of CTA in Figure 9.

3.4. Trial and Error

In proving the system design update, a trial was conducted by the respondents to prove it using the Heuristic Walkthrough method with the same task scenario but different steps and still using the number of previous heuristic aspects with the results in Table 9.

a. Severity Rating Proof Results of Design Improvements

Table 9. LMS Heuristic Walkthrough Improvement Proof Results

v	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	Mean
HE	0,07	0	0,14	0,21	0,07	0,14	0,07	0,07	0,14	0,14	0,78	0,17
CW	0,22	0	0,44	0,11	0,11	0,22	0,11	0	0	0	0,67	0,17

b. Design Correction Error Percentage

The percentage of errors obtained in the Cognitive Walkthrough improvement was 13.13% andfor the Heuristic Evaluation was 12.33%.

3.5. Result

The redesigned LMS prototype was re-evaluated using the same task scenarios and heuristic principles, resulting in an average severity rating of 0.17, indicating only minor cosmetic issues. This shows that the redesign effectively addressed major usability concerns. The Heuristic Walkthrough combines Cognitive Walkthrough, which identifies task-specific usability issues, and Heuristic Evaluation, which detects broader design inconsistencies. Evaluators included both novice and expert users, uncovering 92.8% of errors through Heuristic Evaluation and 95.5% through Cognitive Walkthrough. Future research should explore additional heuristic principles and test the LMS on various devices for cross-platform compatibility.

4. Conclusion

After evaluation using the Heuristic Walkthrough method, errors were identified with 92.8% in Heuristic Evaluation (HE) and 95.5% in Cognitive Walkthrough (CW), with severity ratings above 0. The mean severity rating was 2.72 in HE (major usability problem) and 2.02 in CW (minor usability problem). System improvements were made using the Goal Directed Design method, which provided structured feedback and facilitated collaboration with developers. The prototype improvement trial showed positive results, with a mean rating of 0.17 in both HE and CW, categorized as a cosmetic problem. The new design was easier to understand and more efficient, although further refinement was noted for additional features and responsive displays. Overall, the evaluated LMS shows potential for effective learning support, with the HW and GDD methods proving useful in identifying issues and guiding further development.

Further refinement is needed for features outside the evaluation scenario and other responsive displays. Due to time constraints, the evaluation focused on mobile responsiveness and commonly used features. Additionally, incorporating more heuristic aspects would improve the evaluation results.

References

[1] R. K. Ellis, “Learning Management Systems,” 2009.

[2] M. H. Blackmon, *Berkshire Encyclopedia of Human-Computer Interaction*. Berkshire Publishing, 2004. [Online]. Available: www.berkshirepublishing.com

[3] O. Leßenich and S. Sobernig, “Usefulness and usability of heuristic walkthroughs for evaluating domain-specific developer tools in industry: Evidence from four field simulations,” *Inf Softw Technol*, vol. 160, 2023, doi: 10.1016/j.infsof.2023.107220.

[4] A. Sears, “Heuristic Walkthroughs: Finding the Problems Without the Noise,” *Int J Hum Comput Interact*, vol. 9, no. 3, pp. 213–234, Sep. 1997, doi: 10.1207/s15327590ijhc0903_2.

[5] V. Wati, H. Muslimah Az-Zahra, and N. H. Wardani, “Evaluasi Usability Terhadap User Interface Aplikasi Medizi Berbasis Website Menggunakan Heuristic Walkthrough,” 2019. [Online]. Available: http://j-ptiik.ub.ac.id

[6] M. I. Maksum, B. T. Hanggara, and A. Rachmadi, “Evaluasi Usability dengan Metode Heuristic Walkthrough (Studi Kasus: Website Beasiswa XYZ),” 2021. [Online]. Available: http://j-ptiik.ub.ac.id

[7] Y. Sari, M. Arafah, and Novitasari, “Evaluasi Usability Sistem Informasi Akademik Dosen Menggunakan User Experience Questionnaire dan Heuristic Walkthrough,” *Jurnal RESTI (Rekayasa Sistem dan Teknologi Informasi)*, vol. 5, no. 2, pp. 247–253, Apr. 2021, doi: 10.29207/resti.v5i2.3022.

[8] H. Padmayudha Nugraha, A. Dwi Herlambang, and H. Muslimah Az-Zahra, “Perbandingan Usability Pada Learning Management System Moodle dan Edmodo Dengan Menggunakan Metode Heuristic Walkthrough (Studi Pada SMKN 8 Malang),” 2019. [Online]. Available: http://j-ptiik.ub.ac.id

[9] S. B. Susilo, S. Hadi Wijoyo, and W. S. Wardhono, “Perbandingan Usability Learning Management System Edmodo dan Google Classroom Menggunakan Heuristic Walkthrough (Studi Kasus: SMKN 11 Malang),” 2019. [Online]. Available: http://j-ptiik.ub.ac.id

[10] J. Nielsen, "10 Usability Heuristics for User Interface Design," *Conference companion on Human factors in computing systems CHI 94*, pp. 152–158, 2005, [Online]. Available: http://portal.acm.org/citation.cfm?doid=259963.260333

[11] J. Nielsen, "Finding usability problems through heuristic evaluation," in *Conference on Human Factors in Computing Systems - Proceedings*, 1992. doi: 10.1145/142750.142834.

[12] J. Nielsen, "Severity Ratings for Usability Problems: Article by Jakob Nielsen," 1994. Accessed: Jan. 13, 2024. [Online]. Available: https://www.nngroup.com/articles/how-to-rate-the-severity-of-usability-problems/

[13] E. Wong, "Heuristic Evaluation: How to Conduct a Heuristic Evaluation," 2019.

[14] J. Nielsen, "How Many Test Users in a Usability Study?," Nielsen Norman Group. Accessed: Jan. 14, 2024. [Online]. Available: https://www.nngroup.com/articles/how-many-test-users/

[15] P. M. Hasanah, L. Fanani, and R. I. Rokhmawati, "Perancangan User Experience Learning Management System (LMS) Menggunakan Metode Goal-Directed Design (Studi Kasus: Rakryan Digital Academy)," *Jurnal Pengembangan Teknologi Informasi dan Ilmu Komputer*, vol. 5, no. 7, 2021.