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Optimizing Website Usability through the User Centered Design (UCD) Approach

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ABSTRACT: The 321 website is an interactive web based platform used for quizzes, polling, and spin wheel activities by various user groups. However, preliminary evaluations identified several usability issues, including unclear navigation, repetitive login attempts, non-intuitive interface elements, ineffective search functionality, and inconsistent visual layouts, which negatively affected user experience. This study aims to optimize website usability through the User Centered Design (UCD) approach by redesigning the User Interface (UI) and User Experience (UX) based on user needs and feedback. The optimization process was conducted iteratively through the stages of understanding the context of use, specifying user requirements, producing design solutions, and evaluating the redesigned system. Usability optimization was implemented by restructuring the information architecture, simplifying user flows, improving navigation consistency, refining interface layouts and visual hierarchy, and optimizing the search feature using the Linear Search algorithm. Data collection methods included interviews, observation, questionnaires, usability testing, and User Acceptance Testing (UAT). The results showed that the usability score increased from 2.29 (45.8%) before redesign to 3.97 (79.4%) after implementation, categorized as High. In addition, the UAT result reached 83.8%, categorized as Very Good.

KEYWORDS: Usability, User Centered Design, User Interface, User Experience, 321

I. INTRODUCTION

Advances in information technology have driven the use of websites as the primary medium for information dissemination and digital interaction. In the era of digital transformation, users not only demand ease of access, but also convenience, efficiency, and an optimal interactive experience. Therefore, the quality of the User Interface (UI) and User Experience (UX) has become a critical factor in determining the success of a system, as it directly influences user satisfaction and perception [1]. Consequently, usability evaluation is essential to ensure that the system effectively and efficiently meets user needs.

Website 321 is an interactive platform developed by PT Aidi Digital Global in 2024, featuring quizzes, polls, and a spin wheel. As of July 2025, the platform had been used by approximately 780 users from various backgrounds, including school students, university students, lecturers, teachers, and the general public. Based on interviews with the platform administrators, no systematic usability evaluation had previously been conducted, therefore, the system's level of usability had not yet been objectively measured.

To obtain an initial overview of the usability level, a questionnaire based evaluation was conducted using five usability indicators: learnability, efficiency, memorability, errors, and satisfaction. The evaluation produced an average score of 2.29 (45.8%), which falls into the low category. The errors indicator obtained the highest score of 3.95 (76.6%), indicating a high level of user errors. These findings were reinforced by interview results that identified several issues, such as repeated login requests, a search feature that did not function optimally, and blank pages appearing during scrolling. These issues have the potential to reduce user satisfaction and increase the likelihood of users abandoning the platform.

Based on these conditions, an interface redesign is necessary to improve both interface quality and user experience. UI focuses on visual and interactive aspects such as layout, aesthetics, and color selection, while UX emphasizes the overall experience of users when interacting with the system [2]. This study employs the User Centered Design (UCD) approach, which places users at the center of the system development process. This approach was chosen because the system design process must consider users' needs, characteristics, and experiences to ensure that the developed system not only functions properly but also aligns with user expectations. The UCD approach consists of four main stages: understanding the context of use, specifying user requirements, producing design solutions, and evaluating against requirements [3].

This study aims to evaluate the usability level of Website 321 and redesign its UI/UX using the UCD approach. The results of this study are expected to contribute to the development of user centered design practices and serve as a reference for system developers in improving the quality of digital services.

II. LITERATURE REVIEW

A. *User Centered Design (UCD*

User Centered Design (UCD) is an approach that involves iterative design and development processes with an emphasis

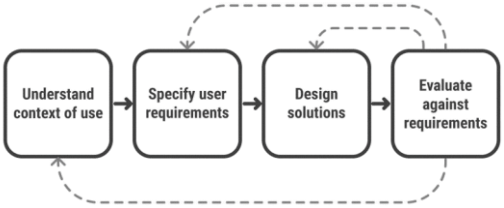

Figure 1. User Centered Design

1. Understanding the context of use
   The initial step in this study is identifying the context of use of the system to be developed. At this stage, designers identify potential users through surveys, interviews, and similar activities.
2. Specifying user requirements
   The second stage focuses on determining user and organizational requirements related to the system. Designers identify user problems in detail and formulate relevant technical and design solutions to ensure the developed system meets actual user needs.
3. Designing solutions
   The third stage is designing solutions based on the analysis of user problems and needs that have been identified previously. Designers develop the initial design of the system or application, such as wireframes, mockups, and prototypes as visual representations of the interface to be developed.
4. Evaluating against requirements
   The fourth stage is evaluating the design according to user requirements. Developers test the designed system interface using usability testing to ensure the design aligns with user needs [5].

The User Centered Design (UCD) method was selected because it places users as the primary focus in the system development process. By positioning users at the center of development, the resulting system is expected to fulfill user needs, expectations, and preferences more effectively. In addition, UCD applies an iterative process through repeated evaluation and refinement based on user feedback. These characteristics show similarities with Agile Software Development, which emphasizes gradual, flexible, and adaptive development. However, Agile primarily focuses on rapid and adaptive software development, whereas UCD emphasizes user involvement in the system design process [6].

Compared to Design Thinking, there are differences in implementation focus. Design Thinking emphasizes innovation, creativity, and idea exploration to solve problems [7]. In contrast, UCD focuses more on user needs, comfort, and preferences through continuous user involvement in the on understanding user needs. UCD can be used to evaluate user efficiency and satisfaction [4]. Based on ISO 13407:1999, the User Centered Design method consists of four stages:

design process. Compared to the Waterfall method, which emphasizes structured, documented, and sequential system development, UCD focuses more on continuous evaluation and design improvement by directly involving users at every stage of development [7].

The main advantage of UCD lies in its ability to identify user needs from the early stages of system development. Through direct user involvement, developers can obtain more accurate feedback so that the resulting system becomes easier to use, more comfortable, and more user friendly. UCD is also related to Human Computer Interaction (HCI) because both are user oriented and aim to create systems that are easy to use. However, HCI focuses more on interactions between humans and computer systems to improve usability and comfort, whereas UCD emphasizes system design processes tailored to the needs and experiences of specific target users [8].

B. *User Interface (UI) and User Experience (UX)*

User Interface (UI) refers to the part of a system that manages the interface and visual appearance of an application. UI elements include visual components such as content layout, text, images, input forms, animations, transitions, and micro interactions. Meanwhile, User Experience (UX) focuses on managing users' interactive experiences when using software, emphasizing ease of use, comfort, and effectiveness in performing available functions [9]. A UX designer is required to conduct research, design, and product testing to understand user needs and produce solutions that are easy to use, enjoyable, and beneficial.

C. *Usability*

Usability testing is a method used to evaluate how effectively and easily users can use a product or service, where website users are directly involved in identifying problems within the tested website [10]. This process involves direct user participation to identify design problems, assess user experience quality, and obtain feedback for design improvement. Usability testing consists of five variables:

1. Learnability Measures how easily users can understand and use the website when interacting with the design for the first time.
2. Efficiency Evaluates user performance after understanding the design by measuring task completion speed.
3. Memorability Measures how easily users can regain proficiency in using the website after a period of not using it.
4. Errors Measures the number and severity of user errors, as well as how quickly users can recover from them.

5. Satisfaction: Measures the level of user satisfaction and enjoyment when using the website design.

The total average score obtained is used to determine the usability assessment category. The usability category indicators and assessment ranges are presented in Table I below.

Table I. Categories in Assessment

Interval	Category
1,00 - 1,80	Very Low
1,81 - 2,61	Low
2,63 - 3,42	Moderate
3,43 - 4,23	High
4,24 – 5	Very High

D. User Acceptance Testing

User Acceptance Testing (UAT) is a system evaluation stage conducted by end users to ensure that the developed system meets business requirements, functional specifications, and user expectations. UAT aims to validate that the system functions properly and is suitable for real operational use [11].

To measure user acceptance, this study uses a 1–5 Likert scale. Each response is weighted according to the respondent's level of agreement. After obtaining the total score, the percentage is calculated to determine the system feasibility level. The interpretation of UAT results is presented in Table II below:

Table II. Categories in Assessment

Percentage	Description
0% - 20%	Very Poor
21% - 40%	Poor
41% - 60%	Fair
61% - 80%	Good
81% - 100%	Very Good

III. METHODOLOGY

This study aims to redesign Website 321 using the User Centered Design (UCD) approach, which places users at the center of the system development process. Based on ISO 9241-210:2010, User Centered Design consists of several stages: Plan the Human Centred Process, Specify the Context of Use, Specify User and Organizational Requirements, Produce Design Solutions, and Evaluate Against Requirements [12].

A. Plan the Human Centred Process

The initial stage of this study was conducted through the plan the human centred process by evaluating the usability of Website 321 before the redesign process. This evaluation aimed to identify system problems and obtain initial data as the basis for user centered design development. The testing involved 20 respondents using a usability questionnaire, and the results were used as primary data for analysis and solution design.

1. Interviews and Respondent Selection

Data collection was conducted through interviews and usability testing to comprehensively understand user needs. Interviews were conducted with Website 321 users to identify problems, weaknesses, and user expectations regarding the system. These criteria were determined to ensure that the selected respondents had relevant experience and characteristics related to the use of Website 321, so that the information obtained could accurately represent the actual system usage conditions.

Table III. User Criteria

No	Criteria
1.	Understands the use of digital technology
2.	Male or female aged ≥ 16 years
3.	Has experience using interactive websites for educational or entertainment purposes
4.	Has experience using interactive features such as quizzes, polls, or spin wheels on interactive websites

2. Implementation of Pre-Redesign Evaluation

The usability testing was conducted by assigning a series of scenario based tasks to the respondents, including exploring the main page, the login process, creating interactive features, and searching for the content they had created. After completing all tasks, respondents were asked to fill out a questionnaire aimed at measuring the usability level of the 321 website. The design of the questions for each indicator is presented in Table

Table IV. Usability Testing Question Indicators

No	Indicator	Questions on the Questionnaire
1.	Learnability	This website is easy to learn
		I can easily and quickly obtain information from the website
		I can easily understand the content and information provided on the website
		I can easily understand the website navigation flow
		I can independently learn how to use the website
2.	Memorability	I can easily remember how to use the website
		I can easily remember the navigation and features of the website
		I can easily use the website at any time
3.	Efficiency	I can access menus quickly

		I can easily obtain information related to the website
		I can directly find the information I need from the beginning
4.	Errors	I did not encounter errors while using the website
		I did not find menus that were erroneous or not functioning properly
		I can easily find the required features and menus
5.	Satisfaction	I am satisfied with the website interface design
		I feel comfortable using the website
		I am comfortable with the colors and layout of the content
		The website meets user expectations

Source : [13]

3. Instrument Validity and Reliability Testing

Before the questionnaire was distributed, validity and reliability tests were conducted to ensure the quality of the instrument. The validity test using Pearson Correlation showed that all 18 items had a calculated value ≥ r table (0.468) with a sample size of 20 respondents, at a significance level < 0.05,

thereby being deemed valid.

Next, a reliability test was conducted to measure the instrument's consistency level using Cronbach's Alpha. The test results showed a Cronbach's Alpha value of 0.980, which is > 0.6, so the questionnaire instrument was deemed to have a very high level of reliability. The output of the reliability test is shown in the following figure.

Reliability Statistics

Cronbach's Alpha	N of Items
.980	18

Figure 2. Cronbach's Alpha Reliability Test Output

B. Specify the Context of Use

The Specify the Context of Use stage was conducted to identify user characteristics, usage objectives, and the conditions of user interaction with the 321 website based on the results of interviews and usability testing from the previous stage.

The interview results showed that general users experienced issues related to visual aspects and interface clarity, such as a monotonous interface and less intuitive icons and menus. In addition, the search feature was considered unable to display content history optimally. Meanwhile, academic users identified functional issues, such as repeated login attempts and blank pages appearing during scrolling.

Based on these findings, user personas were developed as the basis for designing solutions that align with user needs

Table V. User Persona 2

Demographics	Name	Indra Pradnyana
	Age	24 Years Old
	Occupation	Private Employee
Biography	Indra is an employee at a construction consulting company with high work mobility. In his free time, he actively participates in social activities such as gatherings with friends and coworkers.	
Needs	Indra needs a practical and interactive digital platform to support social activities, such as determining turns or creating quick lotteries. Website 321 is chosen because it provides easy to use spin wheel and polling features that make activities more engaging.	
Frustrations	While using Website 321, Indra feels that the interface is still monotonous and less attractive. Some icons do not clearly represent their functions, and blank spaces appearing while scrolling reduce user comfort.	

Table VI. User Persona 2

Demographics	Name	Liangga Ristiana
	Age	22 Years Old
	Occupation	University Student and Freelance Web Developer
Biography	Liangga is an Information Technology student with expertise in technology. His experience as a teaching assistant has made him familiar with digital features, including quizzes as learning evaluation tools.	
Needs	As a university student and teaching assistant, Liangga needs an interactive platform integrated into a single system to support both academic and entertainment activities efficiently.	
Frustrations	Liangga experienced several issues while using the website, such as repeated login attempts and a search history feature that did not function optimally.	

C. Specify User and Organizational Requirements

The next stage involved specifying user and organizational requirements based on the analysis of the context of use and interview results. This stage aimed to identify system requirements related to features, functions, and interface characteristics in the redesign process of the 321 website.

User needs represent user expectations of the system in terms of functionality and ease of use [14]. The identification process was based on interview results and user personas to ensure that the defined requirements aligned with user problems and expectations. In general, the identified needs included improvements in navigation, optimization of system functions, and enhancements to visual and interaction aspects as the basis for developing design solutions.

Table VII. User Needs

No.	User Needs	Persona
1	An attractive and non monotonous interface	Persona 1
2	Clear icons and navigation that match their functions	Persona 1 and 2
3	An easy login process without repeated attempts	Persona 2
4	A search feature capable of displaying content history accurately	Persona 2

D. Produce Design Solutions

At this stage, design solutions were developed through website system design, including Information Architecture, User Flow, Wireframe, and Low Fidelity design for Website 321 after usability testing on the previous website.

1. Information Architecture

The design process began with the development of information architecture to organize Website 321 content and features systematically, making them easier to understand, access, and navigate.

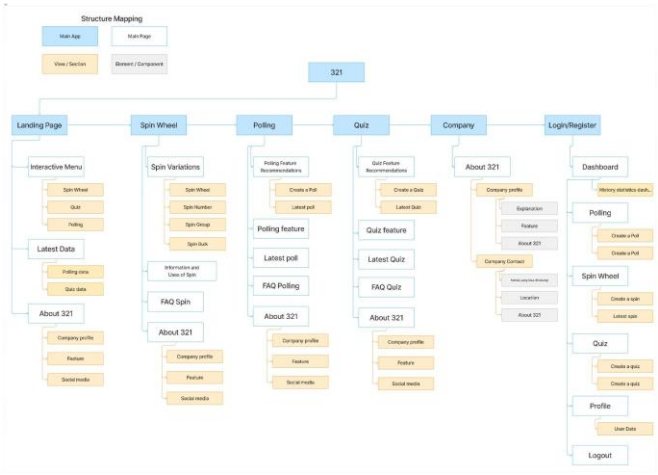

Figure 3. Information Architecture

2. User Flow

User flow illustrates the steps users take to achieve specific goals, such as logging in, creating quizzes, or using polling and spin wheel features.

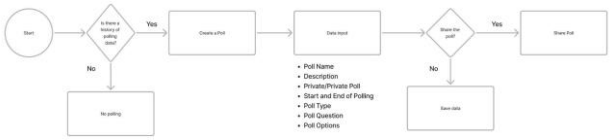

Figure 4. User Flow Create Polling

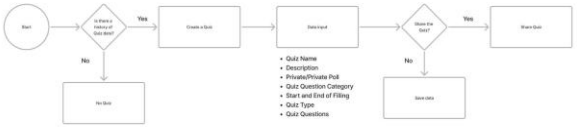

Figure 5. User Flow Create Quiz

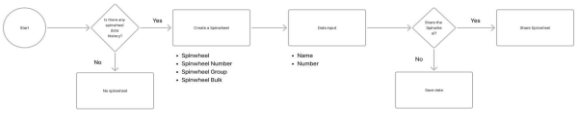

Figure 6. User Flow Create Spin Wheel

3. User Interface Design

a. Wireframe

Wireframe is a simple visual representation that shows the structure and layout of the main design elements.

Figure 7. Wireframe Create Polling

Figure 8. Wireframe Create Quiz

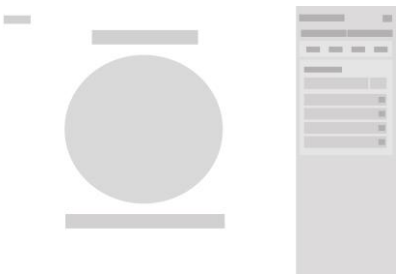

Figure 9. Wireframe Create Spin Wheel

b. Low Fidelity

Low fidelity design is a more detailed stage than wireframe while still maintaining a simple visual appearance without detailed colors or graphics.

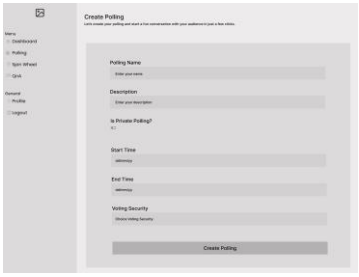

Figure 10. Low Fidelity Create Polling

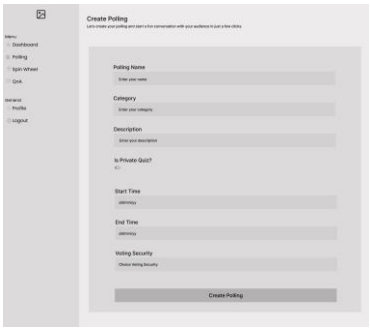

Figure 11. Low Fidelity Create Quiz

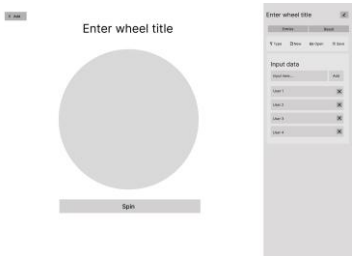

Figure 12. Low Fidelity Create Spin Wheel

4. System Implementation

At this stage, the system was implemented based on the initial usability evaluation and the previously designed system. The website was developed using Visual Studio Code with Laravel as the web application framework. MySQL was used for database management, while XAMPP supported the local server environment during development.

In addition, the Linear Search algorithm was implemented to support the search mechanism in the game history feature. This implementation aimed to help the system search and display data according to user keywords accurately and efficiently when accessing Website 321.

a. Database Design

At this stage, the database for Website 321 was designed before implementation. The design aimed to define data structures and relationships between entities to ensure the system operated in a structured and consistent manner. The design results were visualized using an Entity Relationship Diagram (ERD), which illustrates entities, attributes, and relationships within Website 321.

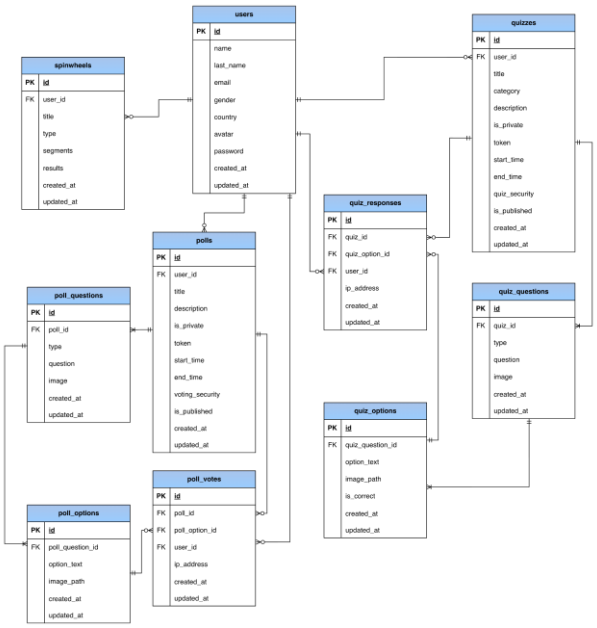

Figure 13. Entity Relationship Diagram

The Entity Relationship Diagram (ERD) of Website 321 illustrates relationships between entities supporting features such as polling, quizzes, and spin wheels. The ERD consists of 10 main entities: Users, Spinwheels, Polls, Poll_Questions, Poll_Options, Poll_Votes, Quizzes, Quiz_Questions, Quiz_Options, and Quiz_Responses. Each entity contains attributes representing stored data and

E. Evaluate Against Requirements

At this stage, statistical data analysis and User Acceptance Testing (UAT) were conducted on the redesigned system. The analysis included normality testing and paired sample t-testing.

1. Data Analysis

a. Normality testing

Normality testing was used to determine whether the data were normally distributed [15]. The decision criteria for the normality test were as follows:

- If the significance value was < 0.05, the data were not normally distributed.
- If the significance value was > 0.05, the data were normally distributed.

b. Paired sample t-testing

Paired sample t-testing was used to determine differences in usability before redesign, after redesign, and after system implementation. The test was conducted on the same respondents with a significance level of 0.05 [16]. The research hypotheses were as follows:

- H0: There was no significant difference in usability between the testing stages.
- H1: There was a significant difference in usability between the testing stages.

The decision criteria for this test were as follows:

- If the significance value was > 0.05, H0 was accepted and H1 was rejected.

- If the significance value was < 0.05, H0 was rejected and H1 was accepted.

2. User Acceptance Testing

After the data analysis was completed, system feasibility testing was conducted using the User Acceptance Testing (UAT) method. This testing directly involved users and focused on aspects of functionality, performance, interface experience, efficiency, as well as system security and reliability, which were measured using a Likert scale questionnaire [11].

Table VIII. UAT Questionnaire List

No.	Variable	Statement
1	System Functionality Evaluation	I can add and update data without problems.
2		The reports generated by this system are accurate and meet user needs.
3		This system provides complete and reliable information.
4		I can search and find specific data easily according to my needs.
5		The search or filter feature functions properly and is very helpful.
6		This system can process input correctly.
7	System Performance Evaluation	This system is always available when needed.
8		The system response speed is very good.
9		The data I enter are always saved correctly.
10		This system provides sufficient features to support work needs.
11	Interface and User Experience Evaluation	This system does not experience interruptions during use.
12		The information displayed in the interface is easy to read and understand.
13		The system has an appropriate color composition.
14		The displayed information matches user expectations.
15		The user interface is easy to understand.
16		I feel comfortable using this system in daily activities.
17		This system helps improve my work efficiency.
18		This system is easy to control and responsive.
19		The layout of menus and buttons is appropriate.
20	Efficiency and Productivity Evaluation	This system helps reduce task completion time.
21		I am satisfied with the automation features provided by this system.
22		This system helps reduce manual workload.
23		Using this system reduces errors in work processes.
24		This system improves collaboration among team members.
25		This system helps decision-making become faster and more accurate.

IV. RESULTS AND DISCUSSION

A. Plan the Human Centred Process

In this stage, the results of the initial usability testing of the 321 website before the redesign are presented. Testing was conducted on 20 respondents based on predefined task scenarios to identify usability levels and major issues as the basis for the redesign.

After completing the tasks, respondents were asked to complete a Likert scale questionnaire to measure five usability indicators: learnability, memorability, efficiency, errors, and satisfaction. The collected data were then analyzed using mean values to determine the system's usability level before the redesign.

Table IX. Average Score of Each Usability Indicator Before Redesign

Variable	Average Score	Indicator Average	Category	Percentage
Learnability	2,60	2,34	Low	47,4%
	2,30			
	2,35			
	2,30			
	2,30			
Memorability	2,55	2,37	Low	48,0%
	2,20			
	2,45			
Efficiency	2,45	2,36	Low	47,2%
	2,30			
	2,35			
	3,55			
	3,95			

Errors	3,55	3,83	High	79,0%
Satisfacation	2,30 2,05 2,20 2,15	2,17	Low	44,6%

The evaluation results showed that all usability indicators were still categorized as low.

1. Learnability: Users were not yet able to fully understand the navigation flow and features during initial use.
2. Efficiency: The system did not support quick task completion, causing users to require more time to find information.
3. Memorability: Users experienced difficulty recalling the navigation structure and menu locations.
4. Errors: A high level of errors was identified, such as malfunctioning features, irrelevant search results, and navigation issues.
5. Satisfaction: This indicator reflected low user comfort and satisfaction with the system's interface and overall user experience

B. Specify User and Organizational Requirements

At the Specify User and Organizational Requirements stage, user and system requirements were defined based on the initial evaluation results and identified problems. These requirements served as the basis for the redesign process to ensure that the resulting solutions aligned with user needs and expectations. The identified requirements were then used as references for the system design development.

Table X. User Requirements

Problem	How Might We	Insight	Problem Findings
Unattractive and monotonous interface design	How might we create a more attractive and engaging interface?	Lack of visual variation reduces user satisfaction	Interview and usability testing results (satisfaction)
Icons and menus are unclear and confusing	How might we ensure icons and menus are easy to understand?	Navigation is not intuitive and difficult to remember	Interview and usability testing results (low learnability and memorability)
Search history feature is not optimal	How might we improve the search feature to provide fast and relevant results?	The search feature does not display the expected content	Interview and usability testing results (efficiency and errors)
Login process requires repeated attempts	How might we simplify and improve the login process?	Repeated login attempts indicate efficiency and system stability issues	Interview and usability testing results (efficiency and errors)
Blank spaces appear while scrolling	How might we maintain interface stability during scrolling?	Blank spaces disrupt the visual experience	Interview and usability testing results (satisfaction)

C. Produce Design Solutions

In accordance with ISO 9241-210, the design process in this study was conducted iteratively by involving users at each evaluation stage to ensure that the design aligned with user needs and expectations. The evaluation was carried out progressively, starting from wireframes, low-fidelity prototypes, and high-fidelity prototypes, where each stage was tested and validated before proceeding to the next stage.

1. Wireframe

At the wireframe stage, testing focused on the basic system structure, including navigation flow and feature placement.

Table XI. Wireframe Evaluation

Component / Feature	Status	Decision
Landing Page	✓	Approved with revisions
Authentication	✓	Approved
Dashboard	✓	Approved
Quiz	-	Not approved
Polling	✓	Approved
Spin Wheel	✓	Approved with revisions
Search Feature	✓	Approved with revisions
Profil	-	Not approved

The evaluation results showed that most structures were understandable, but improvements were still needed in several features, such as simplifying the quiz flow, organizing profile information, and improving search feature visibility.

2. Low Fidelity

The next stage, low fidelity, focused on evaluating the initial visual representation, including interface elements such as icons, typography, and visual hierarchy.

Table XII. Low Fidelity Evaluation

Component / Feature	Status	Decision
Landing Page	✓	Approved with revisions
Authentication	✓	Approved
Dashboard, Quiz, Polling, Spin Wheel	✓	Approved with revisions
Search Feature	✓	Approved
Profile	✓	Approved with revisions

The evaluation results showed improved system clarity compared to the previous stage, although refinements were still needed in several visual elements, such as the use of more representative icons and adjustments to certain interface sections to achieve better consistency.

3. High Fidelity

At the high fidelity stage, the evaluation focused on designs that closely resembled the final product by considering visual aspects, interactivity, and usability.

Table XIII. Wireframe Evaluation

Component / Feature	Status	Decision
Landing Page	✓	Approved
Authentication	✓	Approved with revisions
Dashboard, Quiz, Polling	✓	Approved
Spin Wheel	✓	Approved with revisions
Search Feature	✓	Approved
Profile	✓	Approved
Color	-	Not approved
Background	✓	Approved with revisions

4. High Fidelity Design Development

The results showed that most components had met user needs, although minor improvements were still required, such as adjustments to color composition, background harmonization, and animation settings for certain features. This iterative process ensured that every revision was based on user feedback, resulting in a more optimal final design aligned with user needs before entering the implementation stage. The high fidelity results are presented in the following figure

Figure 14. Redesigned Landing Page Interface

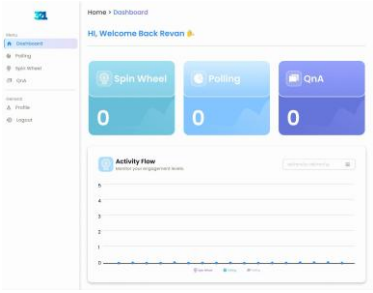

Figure 15. Redesigned Dashboard Interface

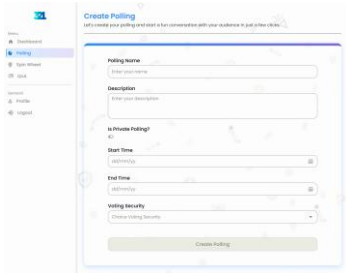

Figure 16. Redesigned Polling Feature Interface

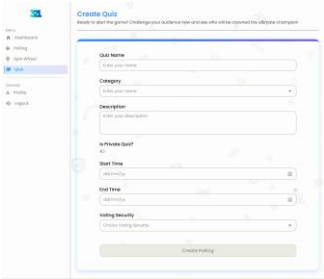

Figure 17. Redesigned Quiz Feature Interface

Figure 18. Redesigned Spin Wheel Feature Interface

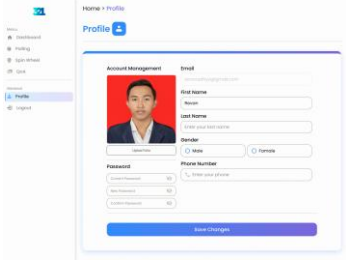

Figure 19. Redesigned Profile Feature Interface

5. Post-Redesign Evaluation Results

At this stage, a post-redesign usability evaluation (UT2) was conducted on the high fidelity prototype of the 321 website. This evaluation aimed to measure improvements in the system's usability following the redesign based on issues identified in the previous testing.

Table XIV. Average Score of Each Usability Indicator After Redesign

Variable	Average Score	Indicator Average	Category	Percentage
Learnability	3,65 3,45 3,65 3,65 3,70	3,62	High	72,4%
Memorability	3,30 3,45 3,50	3,41	Moderate	68,2%
Efficiency	3,50 3,40 3,65	3,51	High	70,2%
Errors	2,80 2,90 2,40	2,70	Moderate	54,0%
Satisfacation	3,55 3,65 3,40 3,45	3,51	High	70,2%

6. System Implementation

The final usability testing stage (UT3) was conducted after implementation by involving the same participants from the previous testing. This evaluation aimed to compare the usability scores of the 321 website before and after the improvements to ensure that the system met user expectations and enabled a consistent comparison of results.

Table XV. Average Score of Each Usability Indicator After Implementation

Variable	Average Score	Indicator Average	Category	Percentage
Learnability	4,10 3,95 3,85 3,55 4,00	3,89	High	77,8%
Memorability	3,95 3,65 4,20	3,93	High	78,6%
Efficiency	4,00 3,95 3,85	3,93	High	78,6%
Errors	1,85 2,05 2,10	2,00	Low	40,0%
Satisfacation	4,15 4,05 3,85 4,25	4,07	High	81,4%

Based on the results of the usability testing conducted, Table XV presents a comparison of the average scores and percentages of each usability indicator for the 321 website as follows:

Table XVI. Comparison of Usability Testing Scores

Usability Score	Before Redesign	After Redesign	Implementation
Average Score	2.29	3.49	3.97
Percentage	45.8%	69.0%	79.4%

The analysis results indicate an increase in usability scores from 2.29 (45.8%) to 3.97 (79.4%). This improvement suggests that the redesign and implementation process significantly enhanced the usability of the 321 website. The system transitioned from a low usability category to a high usability level, demonstrating that the applied design improvements effectively addressed previously identified usability issues.

D. Evaluate Against Requirements

At this stage, the evaluation was conducted using two types of testing methods. The first involved statistical analysis, including a normality test and a paired sample t-test, to identify differences in usability levels across the three testing phases. The second method was User Acceptance Testing (UAT), which was used to validate system functionality based on end user experience.

1. Data Analysis

a. Normality testing

The normality test was applied to determine whether the data were normally distributed. The Shapiro Wilk test was used due to the sample size being less than 50 respondents, as

it is more appropriate for detecting data normality [17]. The results of the normality test are presented in the following figure.

Tests of Normality

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
UT1	.184	20	.074	.920	20	.100
UT2	.146	20	.200*	.926	20	.129
UT3	.137	20	.200*	.937	20	.208

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 20. Output of Normality Test

Based on the normality test results, the significance values for UT1, UT2, and UT3 were 0.100, 0.129, and 0.208, respectively. Since all values are greater than 0.05, the data for each testing stage are considered normally distributed. Therefore, the normality assumption is satisfied, and the analysis can proceed with the paired sample t-test to examine differences in usability levels across the testing stages.

b. Paired sample t-testing

The paired sample t-test was conducted by considering the significance value (2-tailed), where a value of less than 0.05 indicates a statistically significant difference between testing stages.

Table XVII. Paired Samples Test

	Mean	Standard Deviation	T	Sig (2-tailed)
Pretest - Posttest	-1.198	1.317	-4.068	<.001
Pretest - Follow-up	-1.681	.9305	-8.079	<.001
Posttest - Follow-up	-.4825	.9913	-2.177	.042

Based on the overall evaluation results, it can be concluded that the redesign and system development process significantly improved website usability across all testing stages.

2. User Acceptance Testing

At this stage, User Acceptance Testing (UAT) was conducted to evaluate the system's feasibility from the end user perspective. The collected data were analyzed using mean score calculations based on a Likert scale to measure the level of system acceptance.

Table XVIII. Final Results of UAT Calculation

No.	Variable	Weight Value %	Description
1	System functionality	83,3%	Very Good
2	System performance	84,5%	Very Good
3	System interface experience	84,0%	Very Good
4	System efficiency and productivity	83,5%	Very Good

The overall calculation results indicate a feasibility level of 83.8%. This result shows that the 321 website is categorized as "Very Good," indicating that the system meets user expectations and is considered highly acceptable in terms of usability and overall performance.

V. CONCLUSIONS

Based on the results of the research, it can be concluded that the implementation of the User Centered Design (UCD) approach successfully optimized the usability and overall user experience of the 321 website. The optimization process significantly improved the website usability score from 2.29 (45.8%), categorized as Low, to 3.97 (79.4%), categorized as High. In addition, the User Acceptance Testing (UAT) result reached 83.8%, categorized as "Very Good," indicating that the redesigned system was able to meet user needs effectively and function properly without significant technical issues. The most significant improvements were identified in the satisfaction indicator, which reached 4.07 (81.4%), indicating higher user comfort and satisfaction toward the redesigned interface, while the errors indicator improved to 2.00 (40.0%), showing that the system was able to reduce user errors more effectively. These results demonstrate that the redesign process successfully addressed the usability problems identified during the initial evaluation stage.

The usability optimization was achieved through iterative user centered improvements, including the simplification of user flows, restructuring of navigation layouts to improve learnability, enhancement of visual hierarchy and interface consistency, refinement of iconography and color composition to strengthen memorability, and implementation of clear system feedback and input validation to reduce user errors. In addition, the integration of the Linear Search algorithm optimized the search functionality, improving system efficiency and overall user satisfaction.

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