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Article

A Multi-Method Usability Evaluation of a Higher Education Service Evaluation System: Integrating Cognitive Walkthrough, Unmoderated Remote Testing, and Heuristic Evaluation

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Abstract: This study evaluates the usability of a higher education service evaluation system using a multi-method approach that integrates Cognitive Walkthrough, Unmoderated Remote Usability Testing, and Heuristic Evaluation. The study was designed to diagnose usability barriers experienced by new and non-regular users when completing service evaluation tasks independently. The evaluation involved 15 actual users consisting of students, lecturers, and education staff, and three expert evaluators with knowledge of usability, Human-Computer Interaction, and interface design. Cognitive Walkthrough was used to examine learnability barriers across the task flow, Unmoderated Remote Usability Testing was used to capture user-performance evidence, and Heuristic Evaluation was used to classify problems and determine severity. The results show that the system can support completion of service evaluation tasks, but several critical usability issues remain. The most important problems are unclear submission confirmation, less intuitive menu labels, ambiguous service categories, long form interaction, weak mandatory-field cues, and low visibility of the submit button. Remote testing showed the lowest success rates in finding the evaluation menu (73.30%) and confirming successful submission (76.70%). Heuristic Evaluation rated weak submission confirmation as the highest-severity issue. This study contributes a triangulated usability evaluation model for higher education service evaluation systems and provides design recommendations to improve learnability, task efficiency, error prevention, user confidence, and the quality of institutional service evaluation data.

Keywords: Usability; multi-method usability evaluation; Cognitive Walkthrough; Unmoderated Remote Usability Testing; Heuristic Evaluation; higher education service evaluation system.

1. Introduction

Digital transformation has encouraged higher education institutions to develop information systems that support academic services, administrative processes, quality assurance, and evidence-based decision making. One important digital instrument is the service evaluation system, which captures user experience, complaints, perceptions, and

satisfaction with academic and non-academic services [1], [2]. For universities, such systems are not merely administrative forms; they are part of quality governance because the collected data can inform service improvement, resource allocation, and institutional accountability.

The availability of a service evaluation system does not automatically ensure that valid and useful data will be produced. If the system is difficult to understand, users may avoid the process, submit incomplete responses, choose inaccurate service categories, or repeat actions because system feedback is unclear [3]. This issue matters because service quality, student satisfaction, loyalty, institutional image, and word-of-mouth are closely related in higher education service environments [4], [5]. A service evaluation system should therefore enable users to complete evaluation tasks effectively, efficiently, and confidently [6].

Usability is a key requirement for systems that depend on repeated user participation. It refers to the extent to which target users can achieve goals effectively, efficiently, and satisfactorily within a defined use situation [7], [8]. In a higher education service evaluation system, usability includes the ability to find the evaluation menu, understand service categories, complete rating items, provide comments, submit the evaluation, and recognize that the response has been saved. Problems in any of these stages can reduce data completeness and weaken the institution's quality-assurance process [9].

Previous studies have examined usability and user experience in educational digital systems, including digital competency evaluation systems [10], university websites [11], [12], and learning platforms [13], [14]. Other studies emphasize methodological issues in usability testing and inspection methods [15]-[18]. However, many higher education studies still focus on acceptance, satisfaction, or service quality, while fewer studies provide detailed diagnosis of interaction-level barriers in administrative service evaluation systems [19]-[23]. This gap is important because administrative systems outside the learning process are increasingly used for institutional governance but remain less explored than learning management systems or university websites.

A single usability evaluation method may provide only a partial view. User-based testing captures actual behavior, time, errors, and hesitation, but it may not fully explain the design principles violated by the interface. Expert-inspection methods, such as Cognitive Walkthrough and Heuristic Evaluation, can identify learnability barriers and classify design problems, but they require support from real user behavior to strengthen interpretation [24]-[31]. A multi-method approach is therefore needed to connect expert diagnosis, user-performance evidence, and severity-based prioritization [32]-[39].

Based on this research gap, the present study evaluates a higher education service evaluation system by integrating Cognitive Walkthrough, Unmoderated Remote Usability Testing, and Heuristic Evaluation. The research addresses five questions: What usability problems appear in the system? How learnable is the task flow for new and non-regular users? How do actual users perform during remote task completion? Which heuristic principles are most frequently violated? What design recommendations should be prioritized based on severity and triangulated evidence?

The contribution of this study is threefold. Theoretically, it expands usability research into the domain of higher education service evaluation systems. Methodologically, it demonstrates how expert inspection and remote user testing can be integrated to produce a stronger usability diagnosis. Practically, it offers evidence-based recommendations for improving service evaluation interfaces so universities can collect more complete, accurate, and actionable evaluation data.

2. Materials and Methods

2.1. Research Design

This study used an evaluative-descriptive design. The aim was not to test causal relationships among variables, but to identify, analyze, classify, and prioritize usability problems in a higher education service evaluation system. The multi-method design combined Cognitive Walkthrough, Unmoderated Remote Usability Testing, and Heuristic Evaluation so that findings could be triangulated across expert judgment and actual user behavior.

Cognitive Walkthrough focused on learnability, especially whether new or infrequent users could understand the task objective, discover relevant controls, connect each action to the intended goal, and receive adequate feedback. Unmoderated Remote Usability Testing captured behavioral evidence when users completed tasks independently from their own locations. Heuristic Evaluation classified interface problems based on Nielsen's usability principles and assigned severity ratings to support prioritization.

The overall research methodology and experimental pipeline of this study are illustrated in Figure 1.

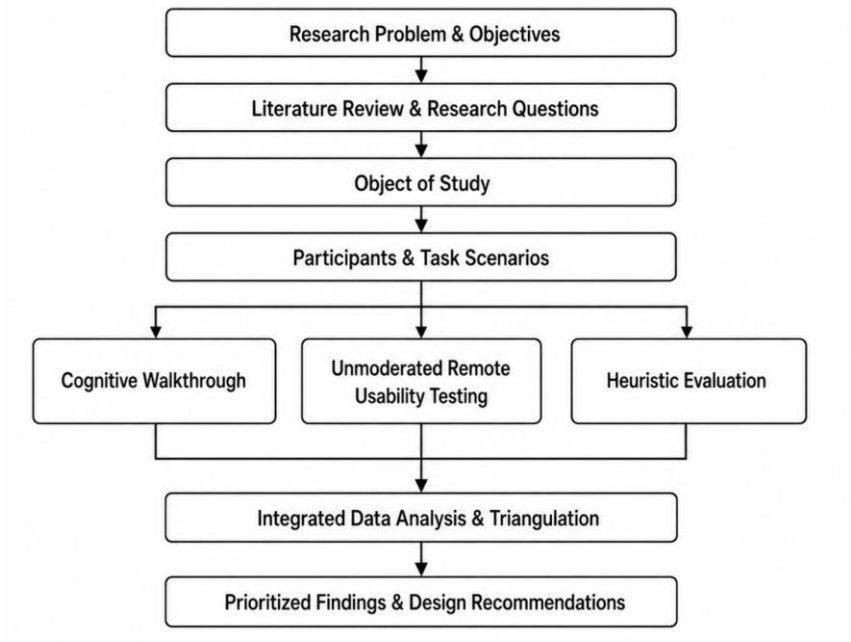

Figure 1. Research Methodology and Experimental Pipeline

2.2. Object of Study and Participants

The object of the study was a web-based higher education service evaluation system used to collect user feedback on academic and non-academic services. The evaluation focused on the main interaction flow: login, navigation to the evaluation menu, service category selection, evaluation form completion, comment submission, final submission, and recognition of successful submission.

The study involved two participant groups. The first group consisted of 15 actual users: students, lecturers, and education staff. The second group consisted of three expert evaluators with knowledge of usability, Human-Computer Interaction, interface design, or digital system evaluation. Purposive sampling was applied because participants had to represent relevant system users or evaluators.

The conceptual architecture of the evaluation framework, including the system under evaluation, the actor groups, and the integration of the three usability evaluation methods, is presented in Figure 2.

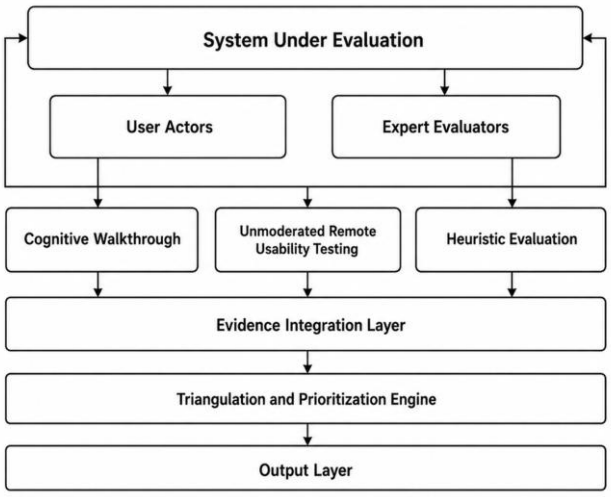

Figure 2. Architecture Model

Table 1. Participants and Evaluation Roles

Participant Group	Number	Role in Study	Selection Criteria
Actual users	15	Completed unmoderated remote usability testing tasks.	Students, lecturers, and education staff who have used or may use the service evaluation system.
Expert evaluators	3	Conducted Cognitive Walkthrough and Heuristic Evaluation.	Participants with knowledge of usability, Human-Computer Interaction, interface design, or digital system evaluation.

2.3. Instruments and Task Scenarios

The instruments were prepared according to the three evaluation methods. The Cognitive Walkthrough instrument consisted of a task scenario sheet and a learnability checklist. The Unmoderated Remote Usability Testing instrument consisted of a task instruction sheet, observation sheet, screen-recording notes, and user feedback notes. The Heuristic Evaluation instrument consisted of a Nielsen-based heuristic checklist and a severity rating form.

Seven task scenarios were developed to represent the actual sequence of service evaluation activities. These scenarios allowed measurement of effectiveness, efficiency, error patterns, and user uncertainty at each step of the interaction flow.

Table 2. Evaluation Methods, Instruments, Indicators, and Outputs

Method	Instrument	Main Indicators	Output
Cognitive Walkthrough	Task scenario sheet and learnability checklist.	Task objective recognition, action discoverability, control recognition, action-goal relationship, and system feedback.	Learnability barriers, user impact, usability implications, and design recommendations.
Unmoderated Remote Usability Testing	Task scenario sheet, observation sheet, screen recording, and user feedback notes.	Task completion status, time on task, error rate, number of clicks, and observed behavior.	User-performance evidence and patterns of navigation, hesitation, errors, and uncertainty.
Heuristic Evaluation	Nielsen-based heuristic checklist and severity rating form.	Violation of heuristic principles, problem frequency, impact, persistence, and severity level.	Problem classification, severity rating, and improvement priority.

Table 3. Task Scenarios Used in the Evaluation

Task Code	Task Scenario	User Goal	Success Criterion
T1	Login to the system	Access the service evaluation system.	User successfully reaches the dashboard.
T2	Find the service evaluation menu	Locate the feature used to evaluate services.	User opens the service evaluation page.
T3	Select a service category	Choose the service category that matches the evaluated experience.	User selects a relevant service category.

T4	Fill out the evaluation form	Complete all evaluation items.	All mandatory items are completed correctly.
T5	Provide comments or suggestions	Add qualitative feedback when needed.	User fills in the comment or suggestion field.
T6	Submit the evaluation	Send the completed evaluation.	User activates the submit button successfully.
T7	Confirm successful submission	Recognize that the evaluation has been saved.	User sees and understands a success confirmation message.

2.4. Data Collection Procedure

Data collection was conducted in three stages. First, expert evaluators completed the Cognitive Walkthrough by examining each task step from the perspective of new or non-regular users. They recorded learnability barriers, potential user confusion, impact on task completion, and initial design recommendations. Second, actual users completed the seven task scenarios independently in a remote setting. The researchers recorded task completion status, completion time, error rate, number of clicks, and screen-recording observations. Third, expert evaluators conducted Heuristic Evaluation by mapping problems to Nielsen's principles and assigning severity ratings.

The remote-testing condition was selected because service evaluation systems are normally accessed online and users may complete evaluations from different locations and devices. This condition provided a more natural view of how users interact with the system without moderator assistance.

2.5. Data Analysis

Quantitative user-testing data were analyzed descriptively. Task success rate was calculated as the percentage of participants who completed each task successfully. Error rate was calculated as the proportion of participants who experienced errors or incomplete task execution. Completion time and average clicks were used as efficiency indicators. Qualitative data from screen recordings, user comments, Cognitive Walkthrough notes, and Heuristic Evaluation notes were coded to identify recurring usability problems.

Each identified problem was mapped to Nielsen's heuristic principles and assigned a severity score from 0 to 4: 0 = not a usability problem; 1 = cosmetic problem; 2 = minor problem; 3 = major problem; and 4 = usability catastrophe. The final priority list was developed through triangulation. Problems that appeared across multiple methods and had higher severity were treated as higher-priority design issues.

$$SR\ (\%) = \frac{N_{success} \times 100}{N_{participants}} \quad (1)$$

$$ER\ (\%) = \frac{N_{errors} \times 100}{N_{attempts}} \quad (2)$$

$$Average\ Time\ on\ Task = \frac{\Sigma t_i}{n} \quad (3)$$

$$Average\ Clicks = \frac{\Sigma c_i}{n} \quad (4)$$

$$Mean\ Severity\ Score = \frac{\Sigma s_i}{m} \quad (5)$$

where N_success is the number of successfully completed tasks, N_participants is the total number of participants, N_errors is the number of errors observed, N_attempts is the total number of task attempts, t_i is the completion time of participant i, c_i is the number of clicks made by participant i, s_i is the severity score assigned to problem i, n is the number of participants, and m is the number of identified usability problems.

2.6. Validity, Reliability, and Research Ethics

Validity was strengthened through method triangulation, task scenarios based on actual user activities, and systematic mapping of findings to heuristic principles. Reliability was supported by the use of structured instruments, evaluator discussion, and consensus in classifying problems and assigning severity ratings.

Ethical considerations included participant consent, confidentiality, anonymization of identity, and the use of data only for academic purposes. Participants were informed about the purpose of the study, the type of data collected, and their right to stop participation at any time.

3. Results

3.1. Cognitive Walkthrough Results

The Cognitive Walkthrough showed that the overall evaluation flow was completable, but several task stages did not fully support new or non-regular users. The most important learnability barriers were found in menu discovery, service category interpretation, form completion, visibility of the submit button, and recognition of successful submission.

The findings indicate that users need stronger cues to understand the service evaluation process without prior training. Ambiguous labels and weak feedback can increase cognitive load, delay task completion, and reduce confidence in the system.

Table 4. Cognitive Walkthrough Findings and Design Recommendations

Task	Main Learnability Barrier	User Impact	Usability Implication	Recommended Improvement
T1	Account recovery and password-error instructions are not sufficiently clear.	Users who fail to log in may repeat the same error.	Higher cognitive load and slower initial access.	Provide specific login-error messages and a visible password-recovery link.
T2	The service evaluation menu label is not prominent and does not directly describe the evaluation function.	New users navigate through several menus before finding the feature.	Lower learnability and higher risk of mis-navigation.	Use a recognizable label such as "Service Evaluation" and place it in a more visible dashboard area.
T3	Some service categories use similar or administrative terms.	Users hesitate when selecting the appropriate category.	Potential misclassification of evaluation data.	Simplify category names and add short descriptions or examples.
T4	Instructions do not clearly explain whether items are mandatory.	Users may miss items or feel unsure whether the form is complete.	Reduced completeness and quality of evaluation data.	Mark required items and add real-time validation.
T5	The comment-field status is not explicitly marked as required or optional.	Users stop and hesitate before continuing.	Longer task completion time and uncertainty.	Add "Required" or "Optional" labels and concise feedback instructions.

T6	The submit button is not visually prominent.	Users take longer to recognize the final action.	Lower efficiency and risk of incomplete evaluation.	Increase button visibility, size, contrast, and placement.
T7	The confirmation message is less visible and not explicit enough.	Users are unsure whether the evaluation has been saved.	Lower trust and repeated verification actions.	Display a clear success message with icon/color emphasis and confirmation that data has been saved.

3.2. Unmoderated Remote Usability Testing Results

Task-based remote testing provided behavioral evidence of usability barriers. Login had the highest success rate (100%), suggesting that initial access was generally manageable. However, finding the service evaluation menu had the lowest success rate (73.30%) and the highest error rate (26.70%). Confirmation of successful submission also showed a low success rate (76.70%) and a high error rate (23.30%).

The longest average time appeared in the form-completion task (210 seconds), indicating that the evaluation form required considerable interaction effort. The average of 18 clicks in this task suggests that users had to interact repeatedly with form elements and scroll through a relatively long display.

Table 5. Unmoderated Remote Usability Testing Results

Task	Scenario	Success Rate	Average Time	Error Rate	Average Click	Key Finding
T1	Login to the system	100%	32 s	6.70%	2	A small proportion of participants entered an incorrect password on the first attempt.
T2	Find the service evaluation menu	73.30%	85 s	26.70%	7	Some participants had difficulty finding the menu because the label was less intuitive.
T3	Select a service category	80.00%	64 s	20.00%	5	Participants hesitated when distinguishing academic and administrative service categories.
T4	Fill out the evaluation form	93.30%	210 s	13.30%	18	Some form items were missed because the display was relatively long.

T5	Provide comments or suggestions	86.70%	75 s	13.30%	4	Some participants did not understand whether comments were mandatory or optional.
T6	Submit the evaluation	90.00%	42 s	10.00%	3	The submit button was less prominent, causing some participants to take longer.
T7	Confirm successful submission	76.70%	38 s	23.30%	4	The confirmation message was unclear, causing participants to double-check.

For clearer visual interpretation, Figure 3 summarizes the task-based usability metrics across the seven evaluation scenarios.

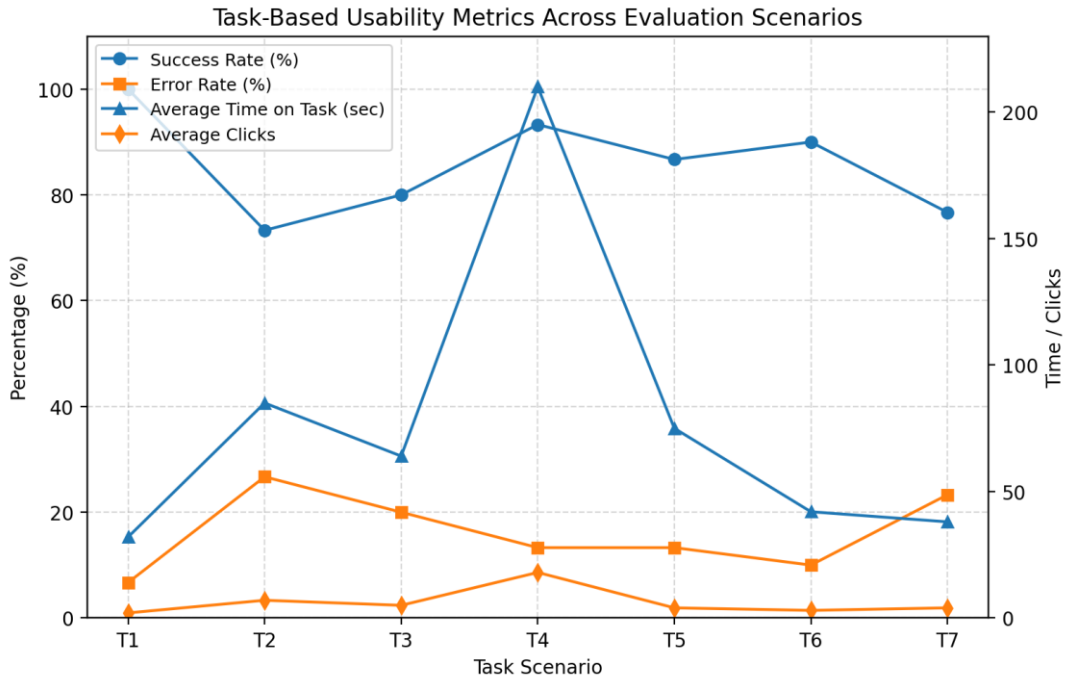

Figure 3. Task-Based Usability Metrics Across Evaluation Scenarios

3.3. Screen Recording Analysis

Screen recordings confirmed that the most frequent obstacle was unclear system feedback after submission, which appeared in 7 of 15 participants. Users returned to the previous page or double-checked the system because the success message was not prominent enough. The second most frequent obstacle was wrong navigation, appearing in 6 of 15 participants, where users opened several menus before finding the service evaluation feature.

These findings strengthen the quantitative results by showing the visible behavior behind task failure, hesitation, and delay. The recordings also indicate that interface problems are not isolated to one screen, but occur across navigation, category selection, form interaction, action-button recognition, and system feedback.

Table 6. Screen Recording Obstacle Categories

Obstacle Type	Number of Appearances	Related Task	Priority	Interpretation
System feedback is unclear	7	T7	Very high	Users double-check because the confirmation message is not sufficiently visible or explicit.
Wrong navigation	6	T2	High	Users open multiple menus before finding the evaluation feature.
Doubt choosing a category	5	T3	High	Service-category terminology does not fully match user understanding.
Action buttons are less visible	4	T6	High	Users search for the final action button or click non-primary areas.
Long forms and missed items	4	T4	Medium	Users scroll repeatedly or miss items in a long form.
Unclear comment instructions	3	T5	Medium	Users hesitate because the comment field is not clearly marked as optional or required.
Initial input error	2	T1	Low	Login is generally understandable, but error messages need to be more informative.

To facilitate pattern recognition, Figure 4 visualizes the dominant obstacle frequencies across the task scenarios based on screen-recording analysis.

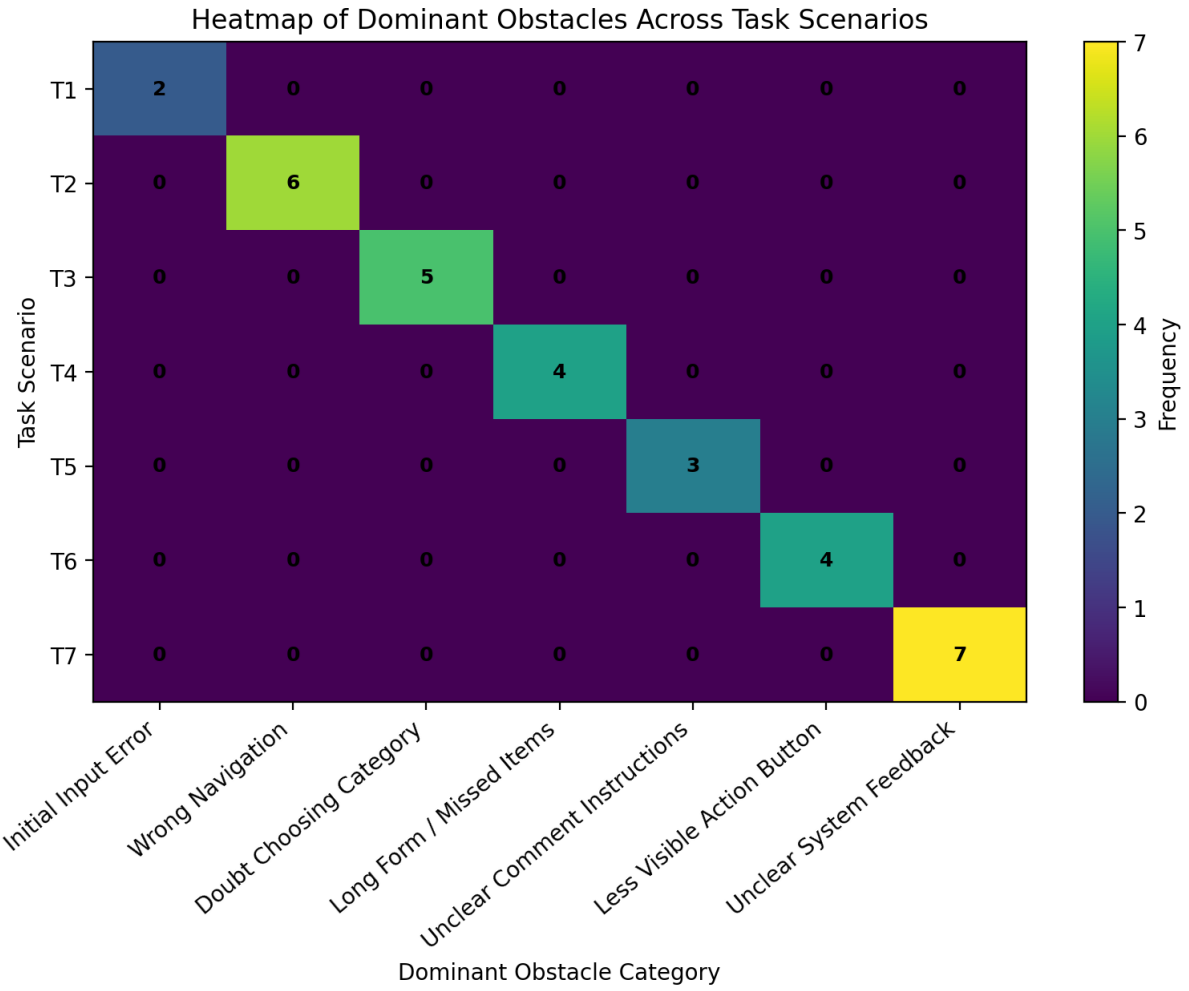

Figure 4. Heatmap of Dominant Obstacles Across Task Scenarios

3.4. Heuristic Evaluation Results

The Heuristic Evaluation classified usability problems according to Nielsen's principles and assigned severity ratings. The highest-severity problem was the weak confirmation message after submission, rated 4 or very high priority. This issue violates the principle of visibility of system status because users cannot easily determine whether the evaluation has been saved.

Other high-priority problems included unclear login error messages, less intuitive menu labels, unfamiliar service category terms, unmarked mandatory items, and weak submit-button visibility. These findings indicate that the system needs improvement in system feedback, match with user language, recognition rather than recall, and error prevention.

Table 7. Heuristic Evaluation Results

Code	Problem Finding	Violated Heuristic Principle	Severity	Priority
H1	The system does not provide a clear message when login fails.	Visibility of system status; help users recognize, diagnose, and recover from errors.	3	High

H2	The service evaluation menu label is less intuitive for new users.	Match between system and the real world; recognition rather than recall.	3	High
H3	Some service categories use less familiar administrative terms.	Match between system and the real world.	3	High
H4	There is no progress indicator when the user fills out the long form.	Visibility of system status; flexibility and efficiency of use.	2	Medium
H5	The system does not clearly mark mandatory items.	Error prevention.	3	High
H6	The submit button is less visually prominent.	Aesthetic and minimalist design; recognition rather than recall.	3	High
H7	The confirmation message after submission is less visible.	Visibility of system status.	4	Very high

4. Discussion

The triangulated results show that the most critical usability problem is weak feedback after submission. Cognitive Walkthrough indicated that new users may not understand whether the evaluation process has been completed. Remote testing showed that users double-checked after pressing the submit button. Heuristic Evaluation classified the problem as a visibility of system status issue with the highest severity. This convergence indicates that submission feedback should be treated as the first design priority.

The second major issue is navigation clarity. Difficulty in finding the service evaluation menu suggests that the information structure does not match users' mental model. A service evaluation system should not require users to remember internal administrative terminology or explore several menus. Clear menu labeling is particularly important because the system is used by heterogeneous groups, including students, lecturers, and education staff, who may differ in digital literacy and familiarity with institutional service categories.

The third issue concerns service category terminology. Ambiguous or overly administrative categories affect not only user experience but also the validity of institutional data. If users select the wrong category, the collected evaluation may be misclassified, reducing the usefulness of the data for quality assurance. This finding shows that usability in service evaluation systems is closely connected to institutional decision quality.

Form design and submit-button visibility also require attention. Long forms can increase cognitive load, lead to missed items, and extend completion time. Weak mandatory-field cues and insufficient validation increase the risk of incomplete responses. The submit button represents the final action in the service evaluation flow; if users cannot recognize it quickly, the process may be delayed or abandoned. The system should therefore use progress indicators, mandatory-field markers, real-time validation, and a visually prominent final action button.

The findings provide three implications. The theoretical implication is that service evaluation systems should be treated as usability-critical institutional systems, not only as data collection forms. The methodological implication is that combining Cognitive Walkthrough, Unmoderated Remote Usability Testing, and Heuristic Evaluation produces a richer diagnosis than using a single method. The practical implication is that universities can improve the quality of service evaluation data by improving learnability, system feedback, error prevention, and user confidence.

Table 8. Triangulated Improvement Priorities

Priority Area	Evidence Across Methods	Design Risk	Recommended Action
Submission confirmation	Cognitive Walkthrough found weak feedback; remote testing showed	Users may not trust that data has been saved and may	Use a visible success message, icon, color emphasis, timestamp,

	double-checking; Heuristic Evaluation rated the issue as severity 4.	repeat or abandon the process.	and a return-to-dashboard option.
Navigation and menu labeling	Cognitive Walkthrough and screen recordings showed difficulty locating the evaluation menu; Heuristic Evaluation linked this to recognition and match with the real world.	Users may fail to find the evaluation feature or require unnecessary navigation effort.	Use explicit labels, group the menu under familiar service categories, and place it in the main dashboard area.
Service category structure	Cognitive Walkthrough and remote testing showed hesitation in selecting categories.	Evaluation data may be misclassified, reducing institutional decision quality.	Simplify category terms and provide brief descriptions and examples.
Form and action-button clarity	Remote testing showed long completion time, missed items, and difficulty recognizing the submit button.	Users may submit incomplete data or fail to finish the evaluation.	Add mandatory markers, progress indicators, real-time validation, and a more prominent submit button.

5. Conclusions and Future Work

This study evaluated the usability of a higher education service evaluation system by integrating Cognitive Walkthrough, Unmoderated Remote Usability Testing, and Heuristic Evaluation. The results show that the system can support the completion of service evaluation tasks, but several usability problems affect learnability, efficiency, error prevention, and user confidence.

The main problems were unclear confirmation after submission, difficulty finding the service evaluation menu, hesitation in selecting service categories, long form interaction, unclear mandatory-field cues, and low visibility of the submit button. The highest improvement priority is the confirmation message after evaluation submission because this issue appeared across all three methods and received the highest severity rating.

The recommended improvements are to provide clearer confirmation messages, simplify menu labels, improve service category structure, strengthen submit-button visibility, add real-time form validation, mark mandatory fields, and provide concise instructions. These improvements are important not only for user experience but also for the quality of service evaluation data used in higher education quality assurance.

This study has limitations. It evaluated one service evaluation system and involved a limited number of participants. Future work should involve larger and more diverse user groups, compare several service evaluation systems from different institutions, and retest the redesigned system to measure improvement in effectiveness, efficiency, satisfaction, and confidence after implementation of the recommendations.

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