Bit-Tech (Binary Digital - Technology)
Vol.9, No.1, August 2026
Available online at: http://jurnal.kdi.or.id/index.php/bt

Design and Evaluation of a School Meal Monitoring System Using Cognitive Walkthrough and PSSUQ

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Article history:

Received 02 Jul 2026;
Revised 14 Jul 2026;
Accepted 8 Aug 2026;
Available online 10 August 2026

Keywords:

Cognitive Walkthrough
Mobile Responsive System
PSSUQ
School Meal Distribution
Usability Evaluation

Abstract

School meal distribution programs require an effective monitoring system to ensure that meals are distributed in the appropriate quantity, quality, and schedule. However, many schools still rely on manual recording procedures, resulting in data inaccuracies, difficulties in monitoring distribution processes, and limited reporting capabilities. This study aims to design and develop a mobile responsive prototype of a school meal distribution monitoring system and evaluate its usability and user satisfaction. This study employs a Design and Development approach consisting of observation, requirements analysis, interface design, prototype development, evaluation using Cognitive Walkthrough (CW), interface improvement, and evaluation using the Post Study System Usability Questionnaire (PSSUQ). The evaluation involved eight respondents consisting of six teachers, one administrative staff member, and one school principal. Respondents completed task scenarios involving meal distribution validation, data recording, documentation, and report monitoring. The CW method was used to identify usability issues, while PSSUQ used a 7 point Likert scale to measure System Usefulness, Information Quality, and Interface Quality. The CW evaluation produced mean scores of 6.50 for Goal Formation, 5.60 for Action Visibility, 5.75 for Action Understanding, and 6.50 for Feedback Evaluation. Interface improvements were implemented before the PSSUQ evaluation. The evaluation results showed positive user perceptions with mean scores of 6.10 for System Usefulness, 5.95 for Information Quality, and 6.20 for Interface Quality. The prototype demonstrated good perceived usability based on user evaluation results

I. INTRODUCTION

School based free meal programs are strategic institutional initiatives designed to fulfill the nutritional needs of school age children while supporting their physical health, cognitive development, and academic achievement. Adequate dietary intake is widely recognized as an important factor influencing student concentration, classroom attendance, cognitive development, and learning outcomes [1],[2]. Furthermore, previous studies have demonstrated that school based nutrition interventions can significantly improve students' cognitive performance and attendance rates [3],[4]. Therefore, the successful implementation of school meal programs is essential not only for improving student welfare but also for supporting broader educational objectives.

The effectiveness of school meal programs does not only depend on food availability but also on the ability of educational institutions to monitor, record, and evaluate the distribution process effectively. An effective monitoring mechanism is required to ensure that meals are delivered to students with the appropriate quantity, quality, and schedule. Without proper monitoring support, schools may experience difficulties in maintaining distribution accuracy, ensuring accountability, and providing reliable information for evaluation and decision making processes.

School meal distribution involves multiple stakeholders, including food providers, teachers, administrative staff, logistics personnel, and school principals. Coordination among these stakeholders is necessary to ensure that

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ISSN 2622-2728 (online) 2622-271X (print)
doi: 10.32877/bt.v9i1.4043

meals are delivered and distributed according to the specified quantity, scheduled time, and proper consumption conditions [5], [6]. However, based on initial observations of school meal distribution activities, monitoring processes are still conducted manually using written records. This condition creates several operational problems, including difficulties in validating the quantity of received meals, discrepancies between delivered and distributed meal quantities, delays in preparing reports, and limited documentation as evidence of the distribution process. The observation results also indicate that schools do not yet have an integrated digital platform to support school meal distribution monitoring activities. Food quality checking is still performed informally without standardized documentation, while information regarding delivery time, remaining meal quantities, student distribution records, and classroom distribution status cannot be monitored directly [7]. Delivery times are also rarely recorded systematically, limiting school management's ability to assess service reliability and operational compliance [8]. From a managerial perspective, school principals require accurate information to support evidence based decision making. However, manual recording practices prevent administrators from obtaining integrated information regarding meal distribution, remaining food quantities, classroom distribution status, and operational issues occurring during implementation [9]. Consequently, monitoring activities tend to become reactive because information is only available after the distribution process has been completed [10]. Digital transformation provides opportunities to support monitoring activities through the design of information systems capable of providing structured and accessible data. The advancement of mobile technology has accelerated the adoption of digital applications in educational administration environments [11], [12].

In school meal distribution activities, teachers and administrative staff frequently perform recording and verification directly at distribution locations. Therefore, a mobile responsive interface design becomes an important requirement to support flexible access through smartphones, tablets, and desktop computers. Responsive interfaces can improve accessibility, usability, and consistency of user interaction across different devices and screen sizes [13]. Previous studies have shown that digital information systems can improve administrative efficiency, increase data accuracy, and strengthen monitoring processes in educational environments [14], [15].

In addition, monitoring dashboards can provide integrated operational information to support managerial decision making processes [16], [17]. However, existing studies have mainly focused on general educational administration systems or digital learning management systems, while research specifically addressing school meal distribution monitoring remains limited [18], [19]. Furthermore, previous studies have mostly emphasized system functionality, whereas usability evaluation considering user experience, interaction difficulties, and user satisfaction has received less attention [20], [21].

Usability evaluation is an important aspect in interface design because the success of a digital solution is influenced not only by available features but also by users' ability to understand and operate the proposed functions effectively. Cognitive Walkthrough (CW) is a usability evaluation method widely used to identify interaction problems by analyzing user actions and task completion processes [22]. However, CW primarily focuses on identifying usability barriers and does not comprehensively measure user satisfaction regarding interface quality. Conversely, the Post Study System Usability Questionnaire (PSSUQ) is widely applied to measure user perceptions regarding system usefulness, information quality, and interface quality after interacting with a prototype [23], [24].

Nevertheless, PSSUQ cannot provide detailed explanations regarding the causes of usability problems encountered during user interaction [25], [26]. Therefore, integrating CW and PSSUQ provides a comprehensive evaluation approach by combining usability problem identification and user satisfaction measurement. Based on these research gaps, this study designs and evaluates a mobile responsive prototype interface for a school meal distribution monitoring system. The prototype includes proposed features such as meal quantity validation, student distribution recording, food quality evaluation, photo documentation, delivery time recording, and monitoring dashboard visualization. The novelty of this study lies in integrating these features into a single mobile responsive prototype interface and applying CW and PSSUQ as complementary usability evaluation methods. Unlike previous studies focusing on general educational administration or learning management systems, this study addresses school meal distribution monitoring from the perspective of users involved in the process. This study aims to design the prototype, identify usability problems using CW, evaluate user satisfaction using PSSUQ, and formulate interface improvement recommendations. The scope of this study is limited to prototype interface design and usability evaluation; therefore, it does not include full operational implementation or measurement of system effectiveness in improving school meal distribution processes.

II. Literature Review

Digital transformation has encouraged the implementation of information systems to improve administrative management, monitoring activities, and decision making processes in educational environments. The utilization of digital technology enables institutions to replace manual recording processes with structured data management, automated reporting, and faster information access. Previous studies have explored various applications of digital systems, including school management platforms, monitoring information systems, usability evaluation

approaches, dashboard visualization, and responsive interface design. However, these studies have different objectives, implementation contexts, evaluation methods, and limitations. Therefore, a comparative analysis of previous research is required to identify the research position and determine the existing gaps related to the development of a school meal distribution monitoring system.

TABLE 1
COMPARISON OF RELATED STUDIES

No	Research	Focus	Method/System	Evaluation	Limitation	Relevance
1	Digital Innovation in School Management[27]	Digitalization of school management processes	Digital management system	Literature study	Does not specifically address food distribution monitoring	Provides a foundation for digital transformation in schools
2	Monitoring Information System [28]	Monitoring operational activities	Monitoring information system	System evaluation	Does not discuss user interaction and usability aspects	Supports the concept of digital monitoring systems
3	Web based Laboratory Monitoring System [29]	Replacing manual recording processes	Web based monitoring system	Blackbox testing	Different domain and focuses on laboratory management	Shows benefits of digital recording and reporting
4	CBT Usability Evaluation Using SUS and PSSUQ [30]	Measuring user satisfaction and usability	SUS and PSSUQ	Questionnaire evaluation	Cannot identify detailed interaction problems	Supports the use of PSSUQ for usability measurement
5	Zoom Usability Testing Using Cognitive Walkthrough[31]	Identifying user interaction barriers	Cognitive Walkthrough	Task based evaluation	Does not measure user satisfaction	Supports CW implementation for identifying usability issues
6	Nutrition Dashboard Using Qlik Sense [32]	Data visualization and analysis	Business Intelligence Dashboard	Visualization evaluation	Does not support operational monitoring activities	Supports dashboard visualization concept
7	Responsive Mobile Interface Design [33]	Responsive user interface development	Mobile responsive interface	Usability testing	Not implemented in school operational systems	Supports mobile accessibility requirements
8	MBG Distribution System in School [34]	Implementation process of school meal distribution	Observation and interview	Qualitative evaluation	Has not implemented digital monitoring support	Provides understanding of MBG distribution workflow

Based on Table 1, previous studies demonstrate that digital systems have been widely applied to improve information management and operational efficiency in various domains. Research on digital innovation in school management shows that information technology can support administrative management, improve operational efficiency, and assist decision making processes in educational environments[27].

Furthermore, studies on monitoring information systems indicate that digital platforms can support structured data collection, information processing, and operational supervision activities [28]. Research on web based monitoring systems also demonstrates that replacing manual recording processes with digital systems can improve data organization, reporting efficiency, and activity tracking capabilities [29]. However, these studies mainly focus on administrative improvement and system functionality, while aspects related to user interaction, usability problems, and user satisfaction remain limited.

Usability evaluation studies provide important insights regarding the relationship between system quality and user acceptance. Research on Computer Based Test (CBT) usability evaluation using SUS and PSSUQ demonstrates that questionnaire based evaluation can measure user perceptions related to system usefulness, information quality, and interface quality [30].

However, questionnaire based evaluation mainly provides quantitative measurements and does not explain detailed interaction difficulties experienced by users during task completion. In contrast, research applying Cognitive Walkthrough to the Zoom application shows that task based evaluation can identify usability barriers, navigation problems, and difficulties in understanding system features [31]. Nevertheless, Cognitive Walkthrough does not directly measure user satisfaction toward the overall quality of the system. Therefore, combining

Cognitive Walkthrough and PSSUQ can provide a more comprehensive evaluation approach by identifying usability problems while measuring user perceptions.

Previous research has also highlighted the importance of information visualization and interface accessibility in digital systems. The implementation of Business Intelligence dashboards using Qlik Sense demonstrates that visualization techniques, such as indicators and graphical representations, can improve data interpretation and support data driven decision making processes [32]. However, this research focuses on nutritional data analysis rather than monitoring operational activities in educational environments. Similarly, research on responsive mobile interface design shows that responsive layouts can improve accessibility, interaction consistency, and user experience across different device sizes [33]. However, the implementation of responsive design for school operational monitoring activities remains limited. In relation to school meal distribution, previous research on the MBG distribution system demonstrates that effective implementation requires coordination among food providers, schools, teachers, and students throughout the distribution process [34]. However, the study mainly discusses organizational processes and collaboration mechanisms without integrating digital monitoring features such as meal quantity validation, food quality evaluation, photo documentation, delivery time recording, student distribution records, and dashboard monitoring.

Based on previous studies, digital management systems, monitoring platforms, dashboards, and usability evaluation methods have been widely developed. However, existing studies have not simultaneously addressed school meal distribution monitoring requirements, mobile responsive interface design, and usability evaluation using complementary methods. Therefore, this study proposes a mobile responsive prototype interface for a school meal distribution monitoring system that integrates meal quantity validation, student distribution recording, food quality evaluation, photo documentation, delivery time recording, and dashboard visualization. The evaluation combines Cognitive Walkthrough and Post Study System Usability Questionnaire (PSSUQ) to identify usability issues and measure user satisfaction after interface improvements.

III. METHODS

This study employed a Design and Development Research (DDR) approach to design and evaluate a mobile responsive prototype interface for a school meal distribution monitoring system. Design and Development Research is commonly used to develop and evaluate products, tools, or systems through systematic design, development, and evaluation stages [28]. The DDR approach was selected because this study focused on developing a prototype and improving its interface quality through usability evaluation based on user feedback. The research process consisted of eight stages: observation, requirements analysis, interface design, prototype development, Cognitive Walkthrough evaluation, usability problem identification, interface improvement, and Post Study System Usability Questionnaire (PSSUQ) evaluation [28].

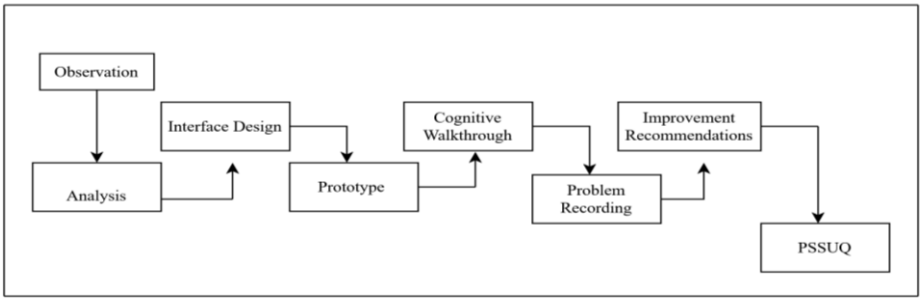

Fig. 1 Research Stages

Figure 1 presents the research workflow illustrating the relationship between each stage, starting from identifying user requirements, designing the interface, developing the prototype, conducting usability evaluation, and implementing interface improvements. The sequential process was conducted systematically to ensure that the developed prototype addressed user needs and followed an appropriate usability evaluation procedure.

The evaluation process combined Cognitive Walkthrough (CW) and Post Study System Usability Questionnaire (PSSUQ) methods. Cognitive Walkthrough was applied to identify potential usability problems during user interaction and task completion, while PSSUQ was used to measure user perceptions regarding the usability quality of the improved interface [30],[31]. The combination of these evaluation methods provided complementary results by identifying specific interaction problems and measuring the overall usability level of the developed prototype.

A. Observation

The observation stage was conducted to analyze the existing school meal distribution process and identify operational problems affecting the development of the proposed monitoring system. The observation involved

teachers, administrative staff, and school principals as stakeholders directly involved in receiving, distributing, validating, and monitoring school meal activities. The observed processes included meal reception, quantity verification, distribution recording, food quality checking, photo documentation, delivery time recording, and report preparation.

The observation results identified several problems in the existing process, including limitations in manual recording, difficulties in monitoring distribution status, lack of digital documentation, and limited availability of real time reports. These findings became the basis for defining system requirements and determining the necessary features of the proposed school meal monitoring system. The results of the observation stage were subsequently used as input for the requirements analysis stage to ensure that the developed prototype addressed actual user needs.

B. Requirements Analysis

The requirements analysis stage was conducted by analyzing the information obtained from the observation process to determine the needs of the proposed school meal monitoring system. This stage aimed to identify the required system functions, user interactions, and information management processes that could support more effective meal distribution monitoring. The analysis results were used as the foundation for designing the prototype structure, interface components, and system interaction flow.

The identified requirements consisted of functional and non functional requirements. The functional requirements included meal distribution recording, food quantity validation, food quality evaluation, photo documentation, dashboard monitoring, and reporting features. Meanwhile, the non functional requirements focused on usability aspects, including ease of interaction, mobile responsiveness, interface consistency, information clarity, and accessibility across different devices.

The proposed system requirements were defined based on three main user roles: teachers, administrative staff, and school principals. Teachers acted as distribution operators responsible for recording student meal distribution activities and submitting related information, while administrative staff performed validation of meal quantity, food condition, and supporting documentation. School principals functioned as monitoring users who accessed dashboard information and reports to evaluate the implementation of the school meal distribution process.

C. Interface Design

Based on the identified requirements, the interface design stage was conducted by applying usability principles and mobile responsive design concepts to ensure that the proposed system could be accessed effectively across smartphones, tablets, and desktop devices[33]. The interface design process focused on creating an interaction structure that supported user activities in monitoring, recording, and validating school meal distribution data. The application of usability principles was intended to improve interface clarity, consistency, efficiency, and ease of use during user interaction.

The interface components were designed according to the functional requirements identified during the requirements analysis stage. The design process included determining interface layouts, navigation structures, input components, information presentation elements, and dashboard visualization features based on the needs of teachers, administrative staff, and school principals. The final interface design represented the visual and interaction framework for prototype development, emphasizing clear navigation flow, consistent visual components, organized information presentation, and simplified user interaction processes. The completed design specification became the primary reference for developing the mobile responsive prototype of the school meal monitoring system.

D. Prototype Development

The interface design was implemented into a prototype using HTML and CSS to represent the proposed school meal monitoring system. The prototype development stage aimed to transform the designed interface into an interactive representation that could demonstrate the proposed system workflow. The developed prototype was designed to simulate the interaction process required for monitoring school meal distribution activities.

The prototype consisted of several main modules, including meal distribution monitoring, food validation, photo documentation, reporting, and dashboard visualization. Each module was developed based on the functional requirements identified during the requirements analysis stage and the interface components designed in the previous stage. The developed prototype represented the interaction flow of the proposed monitoring system involving teachers, administrative staff, and school principals. The prototype was prepared for usability evaluation using Cognitive Walkthrough and Post Study System Usability Questionnaire (PSSUQ) methods [29].

The prototype functioned as an interface representation rather than a fully deployed application because this study focused on evaluating usability aspects and identifying potential interface improvements. The developed prototype provided the interaction environment required for respondents to complete evaluation tasks and assess the usability quality of the proposed system.

E. Cognitive Walkthrough Evaluation

The developed prototype was evaluated using the Cognitive Walkthrough (CW) method to identify usability problems encountered by first time users during task completion. Cognitive Walkthrough is a usability evaluation method that analyzes user actions, interface understanding, and possible difficulties experienced when interacting with a system to complete specific tasks [31]. The evaluation was conducted based on four CW aspects: Goal Formation (GF), Action Visibility (AV), Action Understanding (AU), and Feedback Evaluation (FE).

The evaluation involved eight respondents selected using purposive sampling based on their involvement in the school meal distribution process. The respondents consisted of six teachers, one administrative staff member, and one school principal who represented the primary users of the proposed monitoring system. These respondents were selected because they were directly involved in meal distribution activities, data validation processes, and monitoring activities related to school meal implementation.

The respondents completed six task scenarios representing the main activities of the proposed school meal monitoring system, including verifying meal quantities, recording food distribution data, evaluating food conditions, uploading documentation photos, validating meal information, and monitoring dashboard reports. Each respondent completed the tasks independently while the evaluator recorded usability problems based on the CW evaluation criteria. Each CW aspect was assessed using a seven point Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree), where higher scores indicated better user understanding, easier interaction, and improved perceived usability of the prototype [34].

TABLE 2
LIKERT SCALA

Score	Interpretation
7	Strongly Agree
6	Agree
5	Slightly Agree
4	Neutral
3	Slightly Disagree
2	Disagree
1	Strongly Disagree

The interpretation of the Likert scale used in this evaluation is presented in Table 2, where higher scores represent better user agreement and usability perception.

F. Problem Recording

The usability problems identified during the Cognitive Walkthrough evaluation were documented and analyzed based on the four CW aspects: Goal Formation (GF), Action Visibility (AV), Action Understanding (AU), and Feedback Evaluation (FE). The documentation process was conducted to record interaction difficulties, unclear interface elements, and obstacles experienced by respondents during task completion. The recorded usability issues provided structured information regarding interface components that required further evaluation and improvement.

The identified usability problems were analyzed by reviewing the relationship between user actions, interface elements, and task completion processes. Each problem was categorized according to the corresponding CW aspect to determine the source of usability difficulties encountered by users, including unclear navigation, insufficient information presentation, and difficulties in understanding interface components. The documented findings became the basis for developing recommendations for interface refinement, simplifying user interaction, improving interface clarity, and implementing interface improvements in the next development stage.

G. Interface Improvement

The interface improvement stage was conducted based on usability problems identified during the Cognitive Walkthrough evaluation. The improvement process aimed to address interaction difficulties and interface weaknesses discovered during task completion by respondents. The identified problems were analyzed to determine appropriate modifications that could improve the usability quality of the proposed school meal monitoring system.

The improvement activities involved revising interface components, improving navigation clarity, adjusting visual elements, and simplifying interaction processes. Several modifications were implemented, including enlarging action buttons, increasing visual contrast, adding descriptive labels to interface icons, and reorganizing information layouts to improve user understanding. The improved prototype was subsequently prepared for final usability evaluation using the Post Study System Usability Questionnaire (PSSUQ), and the evaluation results were used to measure user perceptions regarding system usefulness, information quality, and interface quality.

H. Post Study System Usability Questionnaire (PSSUQ)

After the interface improvements were completed, the revised prototype was evaluated using the Post Study System Usability Questionnaire (PSSUQ). PSSUQ is a standardized usability questionnaire used to measure user perceptions regarding System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL) [30]. The questionnaire consisted of 16 items measured using a seven point Likert scale to evaluate users' perceptions of the usability quality of the improved prototype.

The PSSUQ evaluation involved the same eight respondents who participated in the Cognitive Walkthrough evaluation, consisting of six teachers, one administrative staff member, and one school principal. The PSSUQ instrument has been widely applied as a usability evaluation tool for assessing user satisfaction toward interactive systems. In this study, the PSSUQ score interpretation was adapted by reversing the original scoring direction, where higher scores represented better usability perception to align with the interpretation approach used in the Cognitive Walkthrough evaluation.

The collected responses were analyzed using the mean score calculation shown in Equation (1). The mean score was calculated to summarize the questionnaire results and determine the usability level of the improved prototype based on respondent evaluations. The calculated mean scores were interpreted using predefined usability categories presented in Table 3 to classify the usability level of the evaluated prototype.

$$\bar{X} = \frac{\Sigma X}{N} \tag{1}$$

Where :

$\bar{X}$= Mean (average) score

$\sum X$= Total score of all respondents

N= Number of respondents

The calculated mean scores were interpreted using predefined usability categories to classify the quality level of the improved prototype. The interpretation categories are presented in Table 3.

TABLE 3
MEAN SCORE INTERPRETATION

Mean Score	Category
6.01–7.00	Good
5.01–6.00	Fair
4.01–5.00	Moderate
3.01–4.00	Poor
2.01–3.00	Very Poor
1.00–2.00	Extremely Poor

The interpretation categories were determined based on the seven point Likert scale range by dividing the score interval into six usability levels. Higher mean scores indicate better perceived usability of the evaluated prototype. These categories were subsequently used to support the analysis and discussion of the PSSUQ evaluation results.

IV. RESULTS

A. Requirement Analysis Result

The requirement analysis identified several limitations in the existing school meal distribution process, including difficulties in recording meal distribution activities, limited documentation of food delivery, the absence of structured food quality validation records, and limited monitoring information for school administrators. These findings indicate that the existing manual process does not adequately support systematic monitoring and documentation of meal distribution activities. Therefore, the functional requirements of the proposed monitoring system were defined to support a more structured distribution process.

The identified functional requirements include meal distribution recording, food quantity validation, food quality evaluation, photo documentation, delivery time recording, and dashboard based monitoring. The requirement analysis also identified three primary user roles: teacher assistants responsible for recording distribution activities, administrative staff responsible for validating meal information, and school principals

responsible for monitoring reports through the system dashboard. These requirements and user roles became the foundation for designing the prototype interface presented in the next section.

B. System Scenarios

Based on the requirement analysis, six task scenarios were developed to represent the operational workflow of the proposed school meal distribution monitoring system. The scenarios included verifying meal quantities, recording meal information, completing food suitability forms, uploading food documentation, validating meal information, and monitoring distribution reports through the dashboard. These scenarios represented the sequence of activities performed by users during the school meal distribution process.

The task scenarios were designed based on the responsibilities of each user role, where teacher assistants performed distribution recording and documentation activities, administrative staff validated meal information, and school principals monitored reports through the dashboard. The developed scenarios were subsequently used as evaluation tasks in the Cognitive Walkthrough process to identify usability problems during interaction with the prototype. Therefore, the task scenarios became a connection between the requirement analysis stage and the usability evaluation stage.

C. Prototype Development

The identified requirements and system scenarios were translated into a mobile responsive prototype interface. The prototype represented the main functions of the proposed system, including meal distribution monitoring, food validation, documentation, reporting, and dashboard visualization. The developed prototype was designed as an interactive representation to support usability evaluation.

The prototype interface was developed using HTML and CSS to simulate the interaction flow of the proposed monitoring system. The design considered usability principles, navigation clarity, information organization, and responsive layouts for various devices. The developed prototype interface and its main components are presented in Figure 2 as the basis for evaluating user interaction and usability performance.

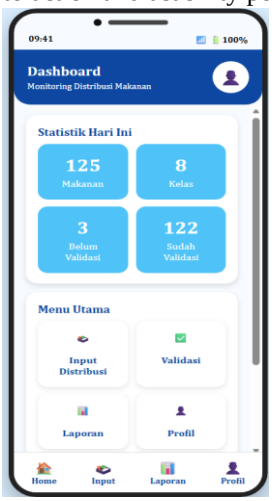

Fig. 2 Mobile Food Distribution Prototype

D. Cognitive Walkthrough Evaluation Result

The Cognitive Walkthrough evaluation was conducted to identify usability problems experienced by users when interacting with the prototype. The evaluation involved eight respondents consisting of six teachers, one administrative staff member, and one school principal. The respondents were selected because they represented the main users involved in meal distribution, data validation, and monitoring activities.

The evaluation was performed using six task scenarios related to the school meal distribution workflow, including verifying meal quantities, recording food information, completing food suitability forms, uploading documentation photos, validating meal data, and monitoring dashboard reports. The Cognitive Walkthrough evaluation consisted of four assessment aspects: Goal Formation (GF), Action Visibility (AV), Action Understanding (AU), and Feedback Evaluation (FE). Each aspect was measured using a seven point Likert scale to evaluate user understanding and interaction difficulties, and the results of the evaluation are presented in Table 4.

TABLE 4
COGNITIVE WALKTHROUGH

Aspect	Problem	Score	Description
Goal Formation	Users understood task objectives	6.50	Good task understanding
Action Visibility	Button is difficult to find	5.60	Low visibility
Action Understanding	Icons are not well understood	5.75	Low comprehension
Feedback Evaluation	Feedback is understandable	6.50	Clear system feedback

The Cognitive Walkthrough evaluation results show that Goal Formation and Feedback Evaluation obtained the highest scores of 6.50, indicating that users were able to understand task objectives and interpret system feedback effectively. Meanwhile, Action Visibility and Action Understanding obtained lower scores of 5.60 and 5.75, respectively, indicating that several interface elements, such as buttons and icons, required improvement. These findings became the basis for interface refinement to improve visibility, comprehension, and overall user interaction with the prototype.

E. Usability Problem and Interface Improvement Result

The usability problems identified from the Cognitive Walkthrough evaluation were analyzed based on the aspects with lower evaluation scores. The analysis focused on identifying interface elements that affected user interaction during task completion, particularly related to button visibility, icon understanding, and interface layout. The identified usability problems were used as references for implementing interface improvements before conducting the final usability evaluation using PSSUQ.

TABLE 5
USABILITY PROBLEM AND INTERFACE IMPROVEMENT

Aspect	Identified Problem	Interface Improvement	Objective
Action Visibility	Button is difficult to find	Increase button size and improve color contrast	Improve interface visibility
Action Understanding	Icons are not clearly understood	Add text labels and use familiar icons	Improve user understanding
Interface Layout	Interface structure is complex	Simplify interface layout	Improve ease of interaction

Table 5 presents the relationship between usability problems identified during the Cognitive Walkthrough evaluation and the implemented interface improvements. The results indicate that users experienced difficulties in finding important interface buttons, understanding visual icons, and navigating complex interface structures. These issues were addressed through design modifications, including improving button visibility, adding descriptive labels, and simplifying the interface layout to support easier user interaction.

F. PSSUQ Evaluation

After the interface improvements were completed, the revised prototype was evaluated using the Post Study System Usability Questionnaire (PSSUQ). The evaluation measured three usability dimensions: System Usefulness (SYSUSE), Information Quality (INFOQUAL), and Interface Quality (INTERQUAL). The evaluation was conducted to assess users' perceptions regarding the usability quality of the improved prototype after the interface refinement process.

TABLE 6
PSSUQ EVALUATION

Aspect	Mean Score	Category
SYSUSE	6.10	Good
INFOQUAL	5.95	Fair
INTERQUAL	6.20	Good

Table 6 presents the results of the PSSUQ evaluation for the improved prototype. Interface Quality (INTERQUAL) obtained the highest mean score of 6.20, followed by System Usefulness (SYSUSE) with a mean score of 6.10. Meanwhile, Information Quality (INFOQUAL) achieved a mean score of 5.95, which was categorized as fair based on the predefined usability interpretation.

The evaluation results indicate that users perceived the improved prototype as having good interface quality and system usefulness. The findings demonstrate that the implemented interface improvements successfully enhanced user interaction and supported easier completion of system tasks. Overall, the PSSUQ evaluation shows that the refined prototype achieved a satisfactory usability level based on user perceptions.

V. DISCUSSION

The results of this study indicate that the developed mobile responsive prototype provides interface features that support digital monitoring activities for school meal distribution. The Cognitive Walkthrough (CW) evaluation identified usability issues related to button visibility and icon comprehension, as indicated by lower scores in Action Visibility (AV = 5.60) and Action Understanding (AU = 5.75), while Goal Formation (GF = 6.50) and Feedback Evaluation (FE = 6.50) showed better user understanding. After interface improvements were implemented, the PSSUQ evaluation showed positive user perceptions regarding usability quality, with System Usefulness (6.10), Information Quality (5.95), and Interface Quality (6.20), indicating that the prototype demonstrated satisfactory usability based on user perceptions rather than operational effectiveness.

Previous research using the Cognitive Walkthrough method reported that usability problems may occur due to difficulties in locating features, understanding interface components, and completing interaction tasks, although

system functionality remains available [31]. This finding is consistent with the present study, where Cognitive Walkthrough successfully identified interface problems related to button visibility and icon understanding before interface refinement was conducted. Previous research on the Computer Based Test (CBT) system at Universitas IPWIJA demonstrated that PSSUQ can be applied to evaluate user perceptions regarding System Usefulness, Information Quality, and Interface Quality aspects [30]. Previous studies on educational monitoring systems demonstrated that digital platforms can support structured data recording, information management, and reporting processes [28]. Research related to school meal distribution systems also highlighted the importance of coordination among schools, teachers, and students to support systematic operational activities [34]. This study extends previous research by integrating school meal distribution monitoring features, including quantity validation, distribution recording, food quality assessment, photo documentation, delivery time recording, and dashboard visualization, while applying Cognitive Walkthrough and PSSUQ for usability evaluation However, this study has several limitations, including evaluation at the prototype stage, a limited number of respondents, the absence of large scale deployment testing, and the lack of reliability testing for the evaluation instruments. In addition, real implementation factors such as internet connectivity, infrastructure readiness, data privacy, and operational scalability were not evaluated in this study. Future research should conduct implementation studies in real school environments involving more diverse participants to evaluate practical applicability and long term system performance.

VI. Conclusions

This study successfully developed a mobile responsive prototype for a school meal distribution monitoring system that integrates meal quantity validation, student distribution records, food quality assessment, photo documentation, delivery time recording, and dashboard visualization. The developed prototype was designed to support structured digital monitoring activities for school meal distribution processes rather than to measure operational effectiveness in real implementation environments. The combination of Cognitive Walkthrough and the Post Study System Usability Questionnaire (PSSUQ) provided a usability evaluation approach by identifying interaction problems and measuring user perceptions after interface improvements.

The main contribution of this study lies in integrating school meal distribution monitoring features with usability evaluation methods within a Design and Development Research approach. Cognitive Walkthrough was applied to identify usability problems related to task completion, interface visibility, and user understanding, while PSSUQ was used to evaluate perceptions regarding system usefulness, information quality, and interface quality after refinement. This user centered evaluation approach provides insights for future development of educational monitoring systems by considering both functional requirements and usability aspects.

This study has several limitations, including evaluation at the prototype stage, a limited number of respondents representing the main user roles, and the absence of large scale deployment testing in real school operational environments. In addition, this study did not evaluate operational effectiveness, such as distribution accuracy, efficiency improvement, long term system impact, infrastructure readiness, internet availability, data privacy, or reliability of the evaluation instruments. Future research should conduct implementation studies involving multiple schools, larger participant groups, and additional features such as QR code based validation, real time notifications, cloud based analytics, and automated reporting to further assess the practical applicability of school meal distribution monitoring systems.

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