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Article

Usability Evaluation of a Web-Based e-KMS for Toddler Nutritional Status Monitoring Using the System Usability Scale (SUS)

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Abstract: A nutritional status assessment system is an electronic health information system that records toddler growth based on age-specific weight and height measurements. Parents may not always maintain appropriate scheduling or regular visits for periodic monitoring at healthcare facilities. This study presents a usability evaluation of a web-based nutritional monitoring system that implements an Electronic Growth Monitoring Card (e-KMS). Users interact with the system through a user interface (UI) and user experience (UX) designed to support effective interaction. The main contribution of this study is the empirical validation of the usability level of a web-based e-KMS in a healthcare context using the System Usability Scale (SUS). The evaluation involved 20 respondents, consisting of parent representatives and daycare teachers or administrators as e-KMS users, and employed 10 SUS statements measured on a five-point Likert scale. The SUS analysis yielded a score of 77.78, indicating a good and acceptable level of usability. These findings demonstrate that the developed e-KMS is suitable for supporting digital-based monitoring of toddler nutritional status in healthcare services.

Keywords: e-KMS; Nutritional Status; System Usability Scale (SUS);

Citation: N. Muna, I. Muflihatin, I. Nurmawati, D. R. P. Mudiono, and A. P. Wicaksono, "Usability Evaluation of a Web-Based e-KMS for Toddler Nutritional Status Monitoring Using the System Usability Scale (SUS)", *ijhitech*, vol. 3, no.2, pp. 177–184, Jan. 2026.

Received: 14-12-2025
Accepted: 21-01-2026
Published: 22-01-2026

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1. Introduction

The Electronic Growth Monitoring Card (e-KMS) has been developed to support digital-based monitoring of toddler nutritional status by enabling systematic recording of growth data [1]. Despite its potential benefits, the effective use of health information systems is strongly influenced by their usability, as poor usability can hinder user adoption and reduce system effectiveness in healthcare contexts [2]. Prior studies on health information system usability report recurring challenges in navigation flow, inconsistency of interface elements, and lack of task efficiency, which negatively impact user satisfaction and interaction quality. For example, usability evaluations of mobile health applications and hospital registration systems using the System Usability Scale (SUS) have identified interface complexity, navigation difficulties, and technical barriers as key issues requiring design improvements [3]. Furthermore, systematic reviews indicate that standardized questionnaires such as SUS are among the most frequently applied tools in the usability assessment of health information systems, particularly when objective measurement of learnability, efficiency, and user satisfaction is required [4].

Given these persistent usability concerns and the varied digital literacy of primary users such as parents and daycare staff, a systematic usability evaluation of the web-based e-KMS is essential to identify interaction barriers and assess system performance. This study aims to evaluate the usability of the e-KMS using the SUS instrument and to provide

empirical evidence on its usability level, thereby contributing to evidence-based recommendations for improving digital health system interfaces [3][4].

Usability deficiencies in healthcare information systems can significantly undermine user experience, resulting in inefficient system use and lower adoption rates [5]. Accordingly, the development of intuitive, user-centered, and accessible UI/UX designs is a critical determinant of the success of digital health technologies. Inadequate interface design may lead to user frustration, reduced engagement, and diminished system effectiveness, thereby compromising the intended outcomes of healthcare service delivery. Consequently, the importance of robust UI/UX design in healthcare information systems has been widely recognized in the literature.

Healthcare information systems must transcend basic functional performance and deliver interfaces that effectively address the heterogeneous needs of diverse user groups, including patients, healthcare professionals, and administrative personnel [6]. Among the various methods available for evaluating system usability, the System Usability Scale (SUS) is one of the most widely adopted instruments due to its simplicity, reliability, and efficiency. Originally developed by John Brooke in 1986, SUS has been extensively validated and applied across multiple domains, including UI/UX design, software applications, websites, mobile platforms, and hardware systems. Its applicability is particularly salient in healthcare contexts, where users exhibit substantial variability in age, educational background, and technological competence.

Failure to incorporate established user interface design principles may result in poorly designed systems that impede access to essential healthcare services and increase the likelihood of system abandonment due to user dissatisfaction. Such shortcomings can ultimately hinder the achievement of a system's core objectives. In response to these challenges, this study seeks to rigorously evaluate the UI/UX of the e-KMS system using the SUS framework, systematically identify its strengths and limitations, and propose evidence-based recommendations to enhance usability and overall system effectiveness. The selection of the SUS methodology is justified by its ease of implementation, time and cost efficiency, broad applicability across system types, and capacity to generate meaningful user-centered insights. The findings of this study are expected to make a substantive contribution to the ongoing development of the e-KMS system by improving alignment with user needs and supporting the successful adoption of digital health technologies.

2. Materials and Methods

This study employs a quantitative descriptive approach to analyze the user interface and user experience (UI/UX) of the Electronic Growth Monitoring Card (e-KMS) nutritional status checking system using the System Usability Scale (SUS) method [7]. This approach aims to obtain a comprehensive understanding of user experience and to identify users' needs, preferences, and challenges when interacting with the system. The research subjects consist of system users who possess valid user IDs and passwords, totaling 20 respondents. Prior studies have shown that SUS provides reliable usability measurements with sample sizes ranging from 10 to 20 participants, particularly in health information system evaluations. Therefore, the selected sample size is considered sufficient to obtain a stable and representative usability score. The respondents consisted of parents of toddlers and daycare teachers or administrators, representing the primary users of the web-based e-KMS system [2]. These user roles were chosen to reflect real-world usage scenarios in digital health monitoring, thereby supporting meaningful interpretation of the usability findings [3].

The primary research instrument used in this study is a questionnaire. The questionnaire was developed based on the SUS approach, emphasizing user-centered design principles through 10 statements. These statements were designed to evaluate users' experiences regarding usability and other relevant aspects of the e-KMS UI/UX.

Responses to each statement were measured using a five-point Likert scale, where 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree [3] [4].

The SUS score calculation is conducted by grouping the questionnaire items into odd-numbered and even-numbered statements.

Odd-Numbered Statements: The score is calculated by subtracting 1 from the respondent's selected value. (Odd-item score = Value – 1)

Even-Numbered Statements: The score is calculated by subtracting the respondent's selected value from the maximum score of 5. (Even-item score = 5 − Value)

All scores from the odd and even statements are then summed. The total score is subsequently multiplied by 2.5 to obtain a final SUS score on a scale of 0 to 100. After calculating the final score, the interpretation of each SUS score category is presented in Table 1.

Table 1. SUS Score Categories

Score Range	Description
Score <50	Poor, requires substantial improvement
50-70	Fair, still requires improvement
70-80	Good, the system is sufficiently adequate
80-100	Excellent, the system is highly user-friendly

3. Results and Discussions

The system is equipped with a data visualization module that presents longitudinal information on toddler growth through graphical representations of nutritional status trends. These visual outputs facilitate systematic evaluation and classification of nutritional status, including normal nutrition, undernutrition, and overnutrition categories. To support long-term monitoring, registered users are required to authenticate through user accounts, enabling access to toddlers' growth histories displayed in the form of an Electronic Growth Monitoring Card (e-KMS). Through the e-KMS, users can monitor toddlers' nutritional development based on periodically recorded assessment data [8].

In addition to authenticated access, the system also provides a public-access module that allows users to obtain caloric requirement estimates without logging into the system. This design aims to enhance system accessibility while maintaining data integrity for personalized monitoring features. The main system interfaces evaluated in this study include data input forms, nutritional analysis outputs, growth visualization components, nutritional status examination histories, and administrative management features [8]. These interfaces are illustrated in Figures 1, 2, and 3.

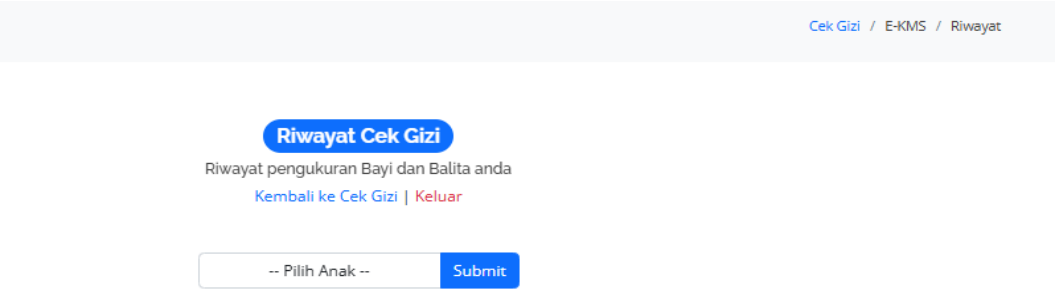


Figure 1. Nutritional Status Monitoring History

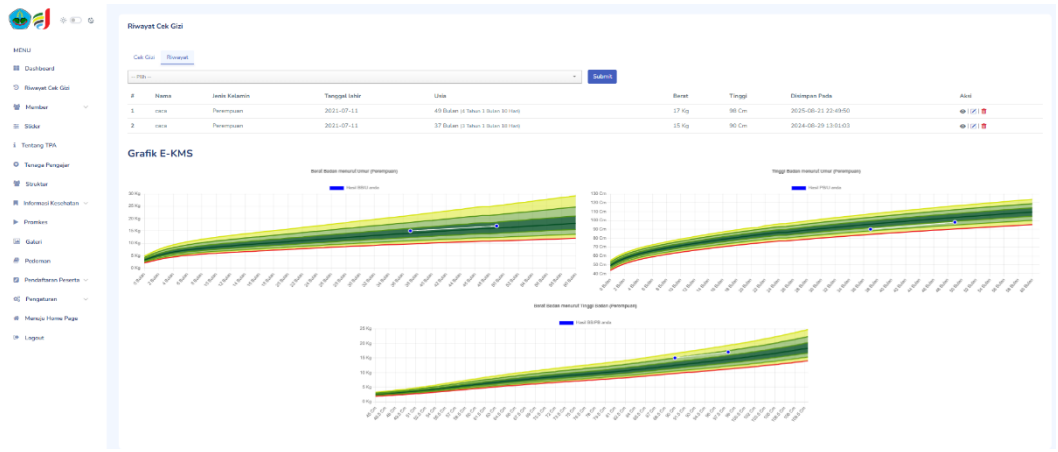


Figure 2. Admin page interface for monitoring toddlers' nutritional status history

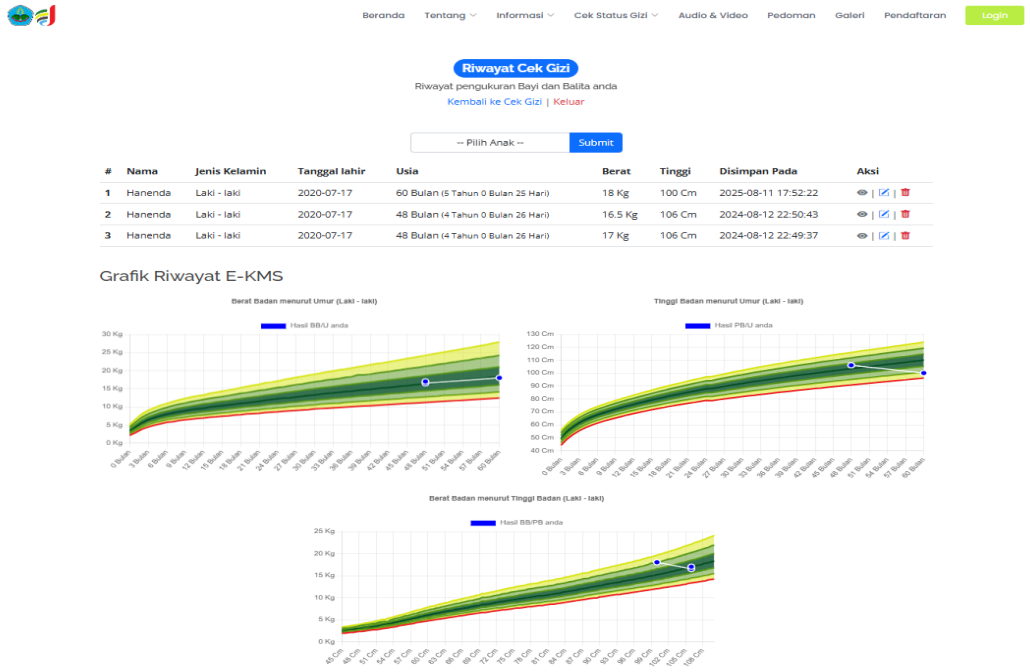


Figure 3. Parent interface for monitoring toddlers' nutritional status history

Table 2 summarizes the results of the user-based usability assessment of the calorie status checking system. Variations in evaluation scores reflect differences in users' interaction experiences with the system. Recent research highlights the critical role of intuitive navigation in enhancing user satisfaction, emphasizing that effective navigation should provide clear, consistent pathways for information retrieval and task completion [7]. Simplified navigation structures and reduced cognitive load are widely recognized as essential strategies for mitigating system complexity [9].

Users with limited digital literacy may encounter greater challenges when interacting with systems such as the e-KMS. These challenges have the potential to exacerbate existing health disparities, as underserved populations may experience restricted access to essential health information [10]. Consequently, healthcare information systems must be designed to be both intuitive and inclusive, ensuring equitable accessibility for diverse user groups. The usability evaluation was conducted by aggregating scores from all positive (odd-numbered) items using Equation (1) and negative (even-numbered) items using Equation (2). The cumulative score was subsequently multiplied by 2.5 to derive the

final SUS score. As presented in Table 3, the system achieved an overall SUS score of 77.875, corresponding to a total score of 623, which indicates a good level of usability and suggests that the system meets user expectations adequately.

The graphical representation of the usability assessment is provided in Figures 3 and 4. Consistency in visual design elements plays a pivotal role in ensuring a coherent and comprehensible user experience. Consistent visual patterns facilitate users' understanding of system interactions, enhance user confidence, and improve overall comfort during system use [10]. Maintaining uniformity across all design components is essential to prevent confusion and to support faster learning and more effective interaction [11].

Table 2. Respondents' Evaluation Using a Likert Scale

No	Statement	Code	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	R13	R14	R15	R16	R17	R18	R19	R20
1	I think that I would like to use this system frequently.	Q1	5	5	5	5	4	4	4	4	4	5	5	4	4	4	4	5	5	4	5	4
2	I found the system unnecessarily complex.	Q2	2	2	3	3	2	2	2	2	3	2	2	2	2	2	2	1	1	2	2	1
3	I thought the system was easy to use.	Q3	5	4	4	5	4	4	4	4	4	4	4	4	3	4	4	5	5	5	5	4
4	I think that I would need the support of a technical person to be able to use this system.	Q4	3	3	3	3	3	1	1	1	2	3	2	2	2	2	2	1	1	1	2	2
5	I found the various functions in this system were well integrated.	Q1	5	4	5	5	2	4	3	4	4	4	4	4	4	4	4	5	5	5	5	4
6	I thought there was too much inconsistency in this system.	Q2	2	1	3	3	3	4	3	2	3	2	2	4	3	2	2	1	1	2	1	1
7	I would imagine that most people would learn to use this system very quickly.	Q3	5	5	5	5	2	4	3	4	4	5	4	3	4	5	4	5	4	5	5	5
8	I found the system very cumbersome to use.	Q4	1	2	2	3	3	2	3	3	3	2	2	2	2	2	2	1	1	1	1	1
9	I felt very confident using the system.	Q1	5	4	4	4	4	4	4	4	4	3	3	3	3	3	3	4	4	5	5	5
10	I needed to learn a lot of things before I could get going with this system	Q2	2	3	2	2	2	2	2	3	2	2	2	2	1	1	1	1	1	1	1	2

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The World Health Organization (WHO) promotes the adoption of information technology to accelerate the achievement of global health objectives, including the reduction of preventable mortality and improved access to high-quality healthcare services [13]. The success of such initiatives is highly dependent on the implementation of user-centered and inclusive system designs. Interfaces that fail to address the diverse needs of users may limit the effectiveness of digital health interventions. Designing systems that accommodate heterogeneous user backgrounds is therefore crucial to maximizing the societal impact of healthcare technologies.

Users reported that key system functionalities—such as user registration, health assessment, and child nutrition monitoring—were easily accessible. These findings are consistent with the principle of system visibility, which emphasizes that critical features should be clearly presented and readily accessible to improve usability, efficiency, and user satisfaction [9]. Empirical evidence further supports that easy access to core functionalities contributes to increased user engagement and enhanced system performance [9].

Users reported favorable evaluations of the main menu design, which provides immediate access to core system functionalities without requiring complex navigation paths. The streamlined menu structure implemented in the e-KMS system reduces interaction steps and supports efficient task completion, aligning with established user interface design principles that emphasize simplicity and directness (Shneiderman & Plaisant, 2005). Such an approach effectively minimizes user frustration and enhances overall usability, as evidenced by the positive user feedback regarding the system's primary navigation [14].

In addition, users appreciated the availability of integrated real-time health information. This functionality adheres to the feedback principle in UI design, which underscores the importance of delivering timely and informative system responses. Real-time data access enables users to make more informed decisions based on up-to-date health indicators, thereby increasing the perceived usefulness and reliability of the system

[15]. Simplicity constitutes a core determinant of system usability and user experience. In this study, the simplicity of the e-KMS interface was evaluated across two primary dimensions: navigational efficiency and visual design clarity. A well-structured navigation flow reduces cognitive load, while a clean and coherent visual layout facilitates faster comprehension and smoother interaction. Consistency further plays a pivotal role in enhancing usability by ensuring predictable system behavior across interface elements. The consistent application of visual components, interaction patterns, and layout conventions supports user learning, strengthens user confidence, and contributes to a seamless and cohesive interaction experience.

Pernyataan Positif (Ganjil)	P1	P3	P5	P7	P9
Jumlah Nilai	69	65	64	66	58
Pernyataan Negatif (Genap)	P2	P4	P6	P8	P10
Jumlah Nilai	60	60	55	61	65
Total Skor	**623**	**Skor SUS**			**77.875**

Table 3. SUS Measurement Results

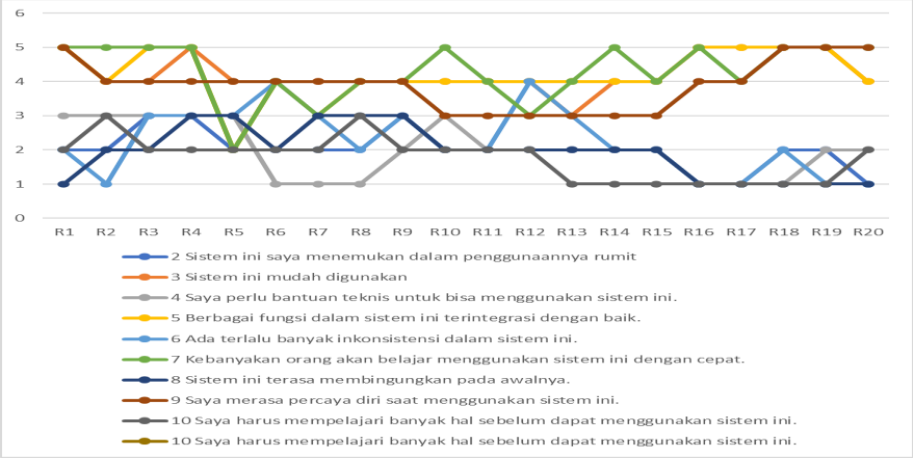


Figure 4. Respondents' Assessment Chart

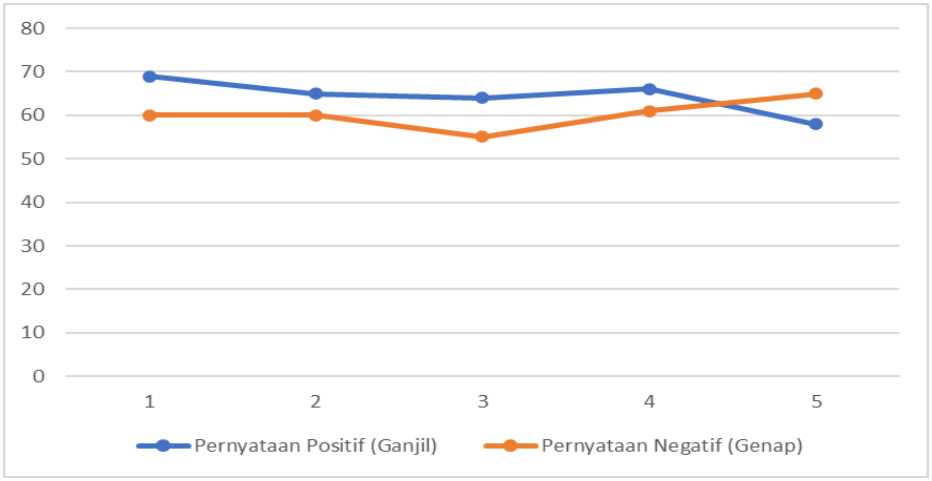


Figure 5. Total System Usability Scale (SUS) Score

4. Discussion

The System Usability Scale (SUS) results reveal specific usability issues that can be directly mapped to the UI/UX golden rules and translated into concrete design improvements. Lower agreement on SUS items related to system complexity and initial confusion (Q2, Q8) reflects challenges in information density and learnability, indicating increased cognitive load during interaction. These findings are closely related to the principles of reduce short-term memory load and design dialogs to yield closure. Applying progressive disclosure, separating summary nutritional indicators from detailed growth data, and organizing content into clearly defined sections would support these principles by minimizing cognitive burden and improving task comprehension [16].

Responses to SUS items concerning the need for technical support and user confidence (Q4, Q9) indicate deficiencies in visibility of system status and informative feedback, which are central to the principles of offer informative feedback and support internal locus of control. The lack of clear visual indicators—such as examination schedules, data submission confirmations, and nutritional status summaries—likely contributed to user uncertainty. Incorporating persistent status indicators, dashboard-based timelines, and real-time feedback mechanisms would strengthen users' sense of control and awareness during system interaction. Furthermore, SUS items related to system integration and consistency (Q5, Q6) point to moderate concerns regarding interface consistency, directly corresponding to the strive for consistency principle. Inconsistent control placement and variation in visual elements across system pages may reduce efficiency and predictability. Standardizing layout structures, navigation patterns, and visual styles across all modules would improve usability and align the system more closely with this golden rule [17] [18].

5. Conclusion

Based on the System Usability Scale (SUS) results, the e-KMS system is classified in the Good category, indicating an adequate level of usability within the scope of this study. Positive user assessments were observed for system consistency and feedback mechanisms, aligning with the strive for consistency and offer informative feedback principles of the UI/UX golden rules. Nevertheless, issues related to information presentation and navigation were identified, indicating that the principles of reduce short-term memory load, design dialogs to yield closure, and support internal locus of control have not been fully addressed. Other principles, including prevent errors, permit easy reversal of actions, enable frequent users to use shortcuts, and cater to universal usability,

were not explicitly evaluated and may be considered in future usability studies to provide a more comprehensive assessment.

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