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Article

The Future of Health Technology: Analyzing User-Based Design in the Electronic Growth Chart Interface

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Abstract: Electronic Growth Chart (e-KMS) is an innovative platform for monitoring children's health by tracking weight and height. The user interface (UI) is designed for intuitive interaction, allowing users to operate the system efficiently. This research aims to analyses the e-KMS UI based on established UI standards using a descriptive quantitative method with a User-Centered Design (UCD) approach. The study involved 15 respondents. Results showed that the system was very easy to use and essential for monitoring children's health. Consistency was evaluated across different devices, revealing that the system functioned uniformly. Feedback was analyses by examining the system's visual cues during key actions such as logging in and inputting a child's data, ensuring users could confirm successful operations. Finally, Visibility was assessed by observing how well users understood the input results, with the system effectively displaying a child's growth chart. The findings highlight the importance of these four UI principles in creating a user-friendly, aesthetically pleasing, and intuitive interface. By adhering to these principles, the e-KMS UI enhances user engagement, satisfaction, and overall user experience, contributing to more effective health monitoring for children. To enhance usability, future improvements should focus on accessibility, streamlined navigation, and user feedback integration.

Keywords: Electronic Growth Chart, User Interface, User Centered Design

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1. Introduction

The integration of digital technology is transforming healthcare by improving access, efficiency, and the quality of care. One system that leverages this technological advancement is the Electronic Growth Chart (e-KMS) [1]. The e-KMS is a novel healthcare solution developed to utilize current opportunities in the ever-evolving field of technology, enabling patients to digitally record and store medical data for life. Despite these advantages, the system's user interface (UI) presents significant challenges for adoption and effective use. Usability issues in healthcare systems can greatly affect user experience, leading to inefficient usage and reduced adoption rates [2]. Therefore, a user-friendly UI is crucial to ensure the success of health technology systems, as poor UI design often leads to user frustration, reducing both engagement and effectiveness of the system.

The importance of a well-designed UI in healthcare technology systems has been widely acknowledged. Healthcare IT systems must go beyond functionality and provide interfaces that meet the diverse needs of users, which include patients, healthcare

professionals, and administrators [3]. User-Centered Design (UCD) is a proven method that ensures the design process canters on user needs, making it particularly relevant for systems like e-KMS. In UCD, users are involved at each stage of the design process, which leads to interfaces that are intuitive and accessible for a wide range of user groups[4]. This is particularly important in healthcare settings, where users may vary significantly in terms of age, education, and technology proficiency.

However, failing to integrate User-Centered Design (UCD) principles results in poorly designed systems that hinder access to essential services and cause users to abandon the system out of frustration. This affects users who struggle to use applications or websites due to poor design, leading to decreased efficiency and productivity. Users may need more time to complete tasks or even fail to complete them. This undermines the primary goal of e-KMS, which is to leverage digital technology to improve healthcare services [5].

This research is crucial for evaluating UI/UX not just from an aesthetic perspective, but also in terms of how design supports the advancement of health technology, enhances user satisfaction, and creates an effective digital experience that helps raise public awareness of the importance of health through digital technology. Without regular evaluations, the risk of failure in delivering healthcare services increases significantly [6].

Therefore, this study aims to evaluate the user interface (UI) of e-KMS using a UCD approach, identify its strengths and limitations, and propose improvements to make the system more user-friendly and effective. The findings of this research are expected to contribute to the future development of e-KMS, ensuring that the system aligns with the diverse needs of its target users.

2. Materials and Methods

This research employs a descriptive quantitative approach to analyze the User Interface (UI) of the Electronic Growth Chart (e-KMS) system using the User-Centered Design (UCD) method. This approach aims to gain a comprehensive understanding of user experience and to identify the needs, preferences, and challenges faced by users while interacting with the system. The subjects of the study are system users with valid user IDs and passwords, selected based on purposive sampling, considering criteria such as frequency of system use, familiarity with health monitoring systems, and relevance to the study objectives, with a total of 15 respondents. The primary research instrument used is a questionnaire. The questionnaire is developed based on the User-Centered Design (UCD) approach (figure 1), emphasizing user satisfaction, usability, and other relevant aspects of the e-KMS UI. A Likert scale scoring system is used to quantify responses, typically ranging from 1 to 5, where: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, 5 = Strongly Agree. This scoring system allows for a structured analysis of user perceptions, making it easier to measure satisfaction, ease of use, consistency, feedback effectiveness, and visibility. The results are then analyzed quantitatively to determine the overall usability and effectiveness of the e-KMS UI. The collected data is analyzed quantitatively using descriptive statistical methods, such as mean, standard deviation, and frequency distribution, to evaluate overall usability. Based on this assessment, conclusions are drawn regarding the effectiveness, usability,

and areas that need improvement in e-KMS UI, thereby providing insight for future improvements.

3. Results

The results of a survey involving 15 participants showed variations in the 4 principles of e-KMS UI indicators based on user usability. The comparison section of the results found in the research results from the processing of questionnaire data can be seen in Figure 6. The following are the details of the data obtained:

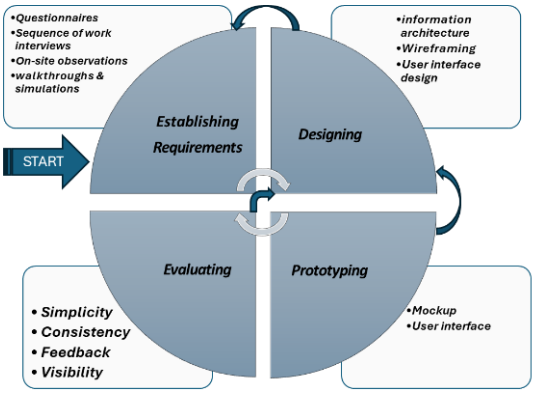

Figure 1. The User-Centered Design (UCD) method

3.1. Simplicity

Simplicity is a crucial aspect of user interface (UI) design that can significantly impact the effectiveness and user experience of a system. In this study, we assessed the simplicity of the e-KMS system based on two key areas: navigation ease and visual design. These findings are summarized as follows according to figure 2:

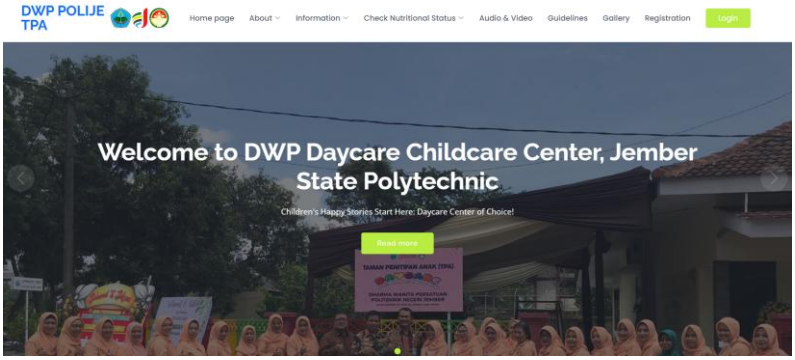

Figure 2. Visual Design

3.1.1. Navigation Ease

- 55% of users reported that navigating the e-KMS system was relatively easy. They appreciated the well-structured menu and clear feature arrangement, which contributed to an intuitive user experience.
- 45% of users encountered difficulties with the system, finding it too complex to access certain pieces of information. This indicates that there are issues with navigation simplicity, as the system's complexity affects user efficiency and satisfaction.

3.1.2. Visual Design

- 40% of users found the visual design of the interface to be clean and simple, which supported ease of use and contributed to a positive user experience.

- 30% of users felt that the visual design was cluttered, with excessive information presented on a single layer. This was particularly noticeable in sections such as audio and video displays, where information overload can overwhelm users.
- 30% of users felt that the visual design did not adequately support simplicity and required updates to reduce confusion and improve overall clarity.

3.2. *Consistency*

Consistency is an important aspect in user interface (UI) design that ensures that design elements throughout the system work in a uniform and predictable way. These findings are summarized as follows according to figure 3:

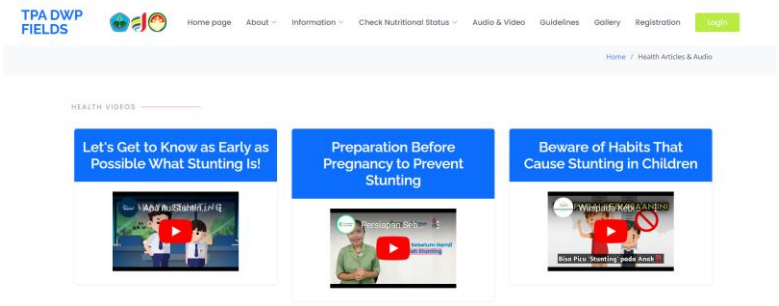

Figure 3. Inconsistent space or layout

- 70% of users report that the visual design elements throughout the system are quite consistent, with uniform use of colours, icons and typography whether accessed on a cell phone or laptop.
- 30% of users feel that visual design inconsistencies disrupt their experience, causing confusion in using the system including, space or layout of information in e-KMS.

3.3. *Feedback*

Feedback from users is a very valuable source of information for assessing the effectiveness and comfort of using the user interface (UI) in the e-KMS system. These findings are summarized as follows according to figure 4.

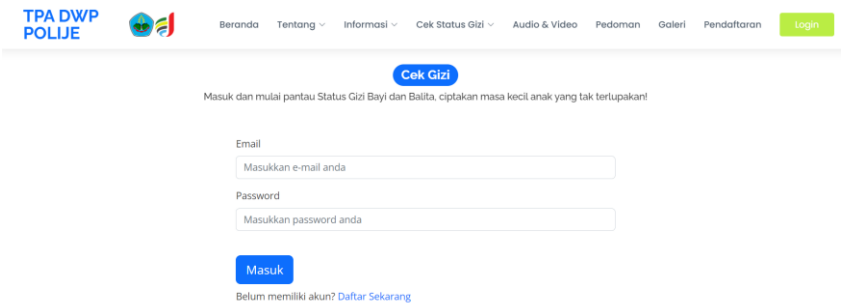

Figure 4. design monitoring toddler nutrition

- Users feel that key features such as registration and health checks as well as monitoring toddler nutrition are easy to access
- They appreciate having a main menu that provides direct access to important functions without having to do a lot of navigation.
- They appreciate the ease of monitoring integrated health information in real-time.

3.4. Visibility

Visibility is a design principle that ensures that important elements in a user interface (UI) are easy to find and access by users. These findings are summarized as follows according to figure 5:

Figure 5. information on monitoring toddler nutrition and examination results

- 55% of users feel that important information such as information on monitoring toddler nutrition and examination results is easy to find and clearly visible on the toddler nutrition calculation page.
- 30% of users feel that some information, such as examination schedule reminders and registration status, is not available in e-KMS
- 15% of users feel that the information displayed is too dense and difficult to read, so they need technical support to help.

4. Discussion

Recent research emphasizes the importance of intuitive navigation in increasing user satisfaction. Effective navigation should provide a clear and consistent path to information and tasks [7]. The fact that 55% of users found navigation relatively easy suggests that the system meets some of these criteria. However, 45% of users experiencing difficulties highlight that complexity in navigation can cause user frustration and reduce efficiency [8]. Simplifying the navigation structure and reducing cognitive load is the key to overcoming this problem [9]. Users with lower digital literacy levels may encounter greater difficulties navigating systems like e-KMS. This can exacerbate existing health disparities, where underserved populations may be unable to access important health information [10]. Therefore, it is crucial to design systems that are not only intuitive but also inclusive, ensuring accessibility for all groups.

Consistency in visual design elements is critical to ensuring a smooth and easy-to-understand user experience. Consistent use of design elements helps users build a better understanding of how to interact with the system, as well as increasing user confidence and comfort [11]. The fact that 70% of users find the visual design consistent supports this theory, indicating that e-KMS systems are quite successful in implementing the principle of consistency across platforms.

However, it is important to maintain this consistency across design elements to avoid further confusion. Visual consistency helps users recognize patterns and understand how the system works emphasize the importance of consistency in accelerating the learning process and increasing the effectiveness of interactions [11]. The World Health Organization (WHO) encourages the use of information technology to accelerate the achievement of global health goals, including reducing deaths from preventable diseases and improving access to quality healthcare services [12].

The success of these initiatives heavily depends on the design of inclusive and user-friendly systems. If the system's interface is not designed with the diverse needs of users in mind, the global health objectives may not be met. A design that considers the diverse backgrounds of users can help bridge this gap and ensure that health technology provides maximum benefits to all segments of the population.

Users find key features such as registration, health checks, and child nutrition monitoring easy to access [13]. This finding is in line with the principle of visibility of system status identified, which emphasizes that important features must be clearly visible and easy to reach to increase efficiency and user satisfaction [11]. Supports this by showing that ease of access to key features contributes to higher user engagement and better system effectiveness [9].

Users appreciate that the main menu provides direct access to important functions without the need for complicated navigation. Intuitive and efficient menu design, as exemplified in e-KMS, reduces the number of steps required to achieve key functions, consistent with the principles of effective UI design outlined by Shneiderman & Plaisant, 2005. Also highlights that simple and straightforward navigation designs help reduce user frustration and improve their overall experience, which is reflected in positive feedback from users regarding the e-KMS main menu [14].

Users appreciate the convenience of monitoring integrated health information in real-time [15]. This feature supports the feedback principle in UI design, where the system should provide clear and timely feedback about status and relevant information. The ability to monitor health data in real time allows users to make better decisions based on current information [9]. Real time feedback not only increases engagement but also increases the system's effectiveness in providing relevant and up-to-date information [16]. Additionally, the ability to monitor health information in real time reflects a technological megatrend that emphasizes the increasing importance of data accessibility and real-time feedback within healthcare systems. As digital health technology advances, the expectation for direct access to health data becomes increasingly critical for users. That real-time feedback can empower users to make better health decisions, highlighting the necessity for health systems to adapt to this trend [17].

Ease of finding important information is a key aspect of the visibility principle. Good design should ensure that important elements are easy for users to find and access [18]. According to Heuristic Evaluation for the Usability of Health Information Systems [19], good visibility influences user engagement with the system and their satisfaction. The results show that information such as nutritional monitoring and examination results clearly appear to support the principle of effective visibility, which is important for increasing efficiency and user satisfaction.

Limitations in the availability of information may indicate problems with the visibility principle. Emphasize that the availability of clear and timely information is key to maintaining user engagement [20]. The unavailability of examination schedule reminders and registration status can cause confusion and reduce the effectiveness of the system. Addressing this problem requires improvements in how information is presented and accessed.

High information density can reduce visibility and make the interface less user-friendly [21]. According to Information Overload and User Interface Design [22], presenting information that is too dense can cause information overload and reduce

system effectiveness. A clean, well-structured design is important for improving readability and reducing the need for technical support. Overcrowded information not only reduces visibility but also increases the user's cognitive load.

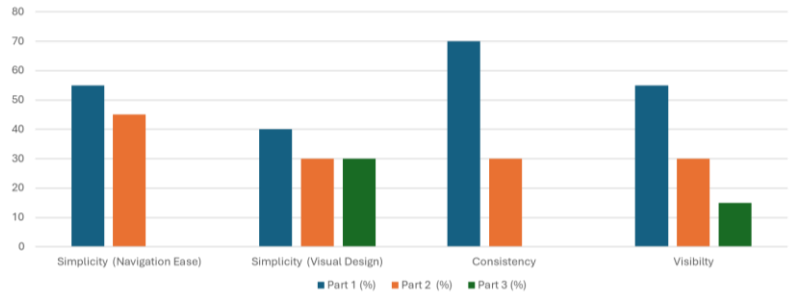

Figure 6. The comparison section of the results

Figure 6 illustrates a comparison of several indicators. For the consistency indicator, respondents stated that e-KMS can be accessed flexibly across multiple devices without display issues. Meanwhile, for the visibility indicator, respondents experienced difficulty reading information on the child toddler monitoring chart.

5. Conclusions

The survey results indicate that the Electronic Growth Chart (e-KMS) system demonstrates strengths in consistency and feedback but requires improvements in navigation simplicity and information visibility. While many users' express satisfaction with the accessibility of key features and visual design, challenges such as system complexity and information density persist. Future recommendations based on the assessment results for indicators that require improvement, particularly in user visibility, emphasize the need to address difficulties in reading dense information, such as interpreting charts. This indicator received the lowest rating. Therefore, it is necessary to improve the interface design. It is recommended that the research also includes a redesign of interface elements that scored below 60 percent and enhancements to the interface to make it more user-friendly. Enhancing the user interface (UI) is not only crucial for improving user experience but also holds global relevance in the context of healthcare digitalization. By adapting to future health trends, e-KMS can contribute to equitable access to healthcare services, particularly in resource-limited settings. Therefore, prioritizing UI design improvements is essential to meet the diverse needs of users and address upcoming global health challenges.

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