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Optimizing Da'wah Through the MASJIDA Application: A Cognitive Ergonomics Approach to Enhance User Experience

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Abstract: This study investigates how cognitive ergonomics-based interface design can enhance user experience and reduce cognitive workload in digital da'wah applications, using the MASJIDA mobile application as a case study. While existing digital da'wah platforms primarily emphasize functional features and content dissemination, limited attention has been given to systematic evaluations of usability and cognitive load. To address this gap, this study integrates cognitive ergonomics principles into the design and evaluation of MASJIDA, a mobile application developed to support mosque management and congregational engagement. A pre-test and post-test experimental design was employed involving mosque administrators and congregants. System usability was measured using the System Usability Scale (SUS), while cognitive workload was assessed using the NASA Task Load Index (NASA-TLX). The results demonstrate a substantial improvement in usability, with SUS scores increasing from 55.1 to 79.3 for congregants and from 55.5 to 85.4 for mosque administrators. In parallel, NASA-TLX results reveal a significant reduction in mental demand, effort, and frustration, indicating lower cognitive workload after implementation. These findings confirm that applying cognitive ergonomics principles contributes not only to improved usability but also to more cognitively efficient user interactions. This study provides empirical evidence and analytical insights for the development of user-centered digital religious applications that balance functional effectiveness with cognitive accessibility.

Keywords: Cognitive ergonomics; User experience evaluation; Mobile application design; Digital da'wah technology; NASA-TLX and SUS

1 Introduction

Da'wah is the core of spreading Islamic teachings, and in the Indonesian context, it plays a crucial role in guiding people towards a better life in accordance with religious principles. Over time, da'wah methods have undergone significant transformation. Traditionally, da'wah was conducted through direct lectures, religious study groups, and scholarly assemblies, with a face-to-face approach limited to local reach [1]. However, with the rapid development of digital technology, particularly in the fields of communication and information, da'wah can now reach a wider audience through digital platforms, such as mobile apps and social media. Technology provides new opportunities to spread da'wah messages more effectively and efficiently to a community increasingly connected to the digital world [2].

In this study, the term "da'wah technology" refers to the use of digital technologies, such as mobile applications, web-based platforms, and information systems, to support the management, dissemination, and implementation of da'wah activities in a structured, accessible, and interactive manner. In the context of Indonesian culture, da'wah is an organized religious communication activity generally carried out by mosques, preachers, and religious institutions to guide the Muslim community. Therefore, da'wah technology functions not only as a medium for conveying religious messages but also as a means of supporting mosque management and increasing congregational participation.

In Indonesia, the country with the largest Muslim population in the world, digital transformation in da'wah (Islamic outreach) is highly relevant. One concrete example is Batam City, with a population of over 1 million, the majority of whom are Muslim [3]. Although many mosques in Batam regularly conduct da'wah activities, the management of these da'wah activities is still limited to conventional methods that cannot reach more congregants or increase their participation in da'wah activities. Furthermore, communication between preachers and congregants, as well as coordination between mosques, is often limited by time and space. These limitations indicate that conventional mosque management and da'wah methods are not fully capable of meeting the communication and participation needs of the community in the digital age.

In this context, technology can play an important role in optimizing mosque management and da'wah [4]. However, the effectiveness of utilizing this technology is not only determined by the completeness of the features, but also by the extent to which the application can be understood and used easily by users. One innovation that has emerged is the MASJIDA application, a digital platform designed to assist mosque management, strengthen the relationship between preachers and congregations, and facilitate the dissemination of da'wah information more efficiently. This application provides various features that allow mosque administrators to manage activity schedules, communication between mosques, and provide easy access for congregations to attend religious studies or participate in mosque activities.

Although the MASJIDA application has great potential in supporting mosque management and da'wah, its success rate is highly dependent on the suitability of the application design to the cognitive abilities and digital literacy levels of users. Therefore, the application of cognitive ergonomics in application design is crucial. Cognitive ergonomics, which focuses on the interaction between users and systems, aims to reduce users' cognitive load and increase comfort and ease of interaction with applications [5–7]. The principles of cognitive ergonomics in application design can make it easier for users to access information, reduce confusion, and improve the overall user experience [8–10].

According to data from the National Statistics Agency (BPS), around 76% of Indonesia's population has internet access, and more than 50% of them use mobile devices to access digital services [11, 12]. In Batam, approximately 70% of the population has internet access, indicating significant potential for the use of digital applications in da'wah activities. However, data also indicates challenges in technology adoption, especially among those less familiar with digital applications. Users unfamiliar with technology tend to struggle to adapt to complex or non-intuitive applications. Therefore, it is crucial to design the MASJIDA application with cognitive ergonomics principles to ensure it can be easily used by a wide range of users, from preachers to congregants with varying levels of digital literacy.

Although various da'wah applications and digital platforms have been developed for the purpose of managing mosques and disseminating da'wah information [13]. Research on the application of cognitive ergonomics in the design of Islamic preaching applications is still very limited. Most existing studies focus more on the use of social media in Islamic preaching or the use of technology in general without considering how application design can affect user interaction and the effectiveness of the technology's use. Research that specifically examines the application of cognitive ergonomics in Islamic preaching applications such as MASJIDA, which is designed for mosque management and the dissemination of Islamic preaching, is still very rare. Thus, there is a significant gap in research examining the influence of cognitive ergonomics on user experience in the context of Islamic preaching applications.

This study aims to fill this gap by examining how the application of cognitive ergonomics in the design of the MASJIDA application can improve user experience and support more effective mosque management. By analyzing how application design can minimize user cognitive load and increase the effectiveness of application use, this study is expected to make a significant contribution to the development of technology-based da'wah applications. To

achieve this goal, this study uses a cognitive ergonomics approach combined with empirical evaluation methods for usability and user cognitive load that are more user-friendly and effective. In addition, this study will also provide design recommendations for other da'wah application developers, with a focus on cognitive ergonomics principles to improve user experience.

The MASJIDA application not only offers practical solutions for mosque management but also has the potential to strengthen da'wah (Islamic outreach) in Indonesia by leveraging technological advances. Therefore, this research is highly relevant in the context of the development of da'wah in the digital era and can provide new insights for the development of technology in the field of da'wah that is more integrated and effective. By examining this application through the lens of cognitive ergonomics, this research seeks to ensure that the application is not only beneficial in disseminating information but also easily accessible and usable by various levels of society, from users familiar with technology to those who are new to it.

Therefore, this study positions cognitive ergonomics not merely as a design consideration, but as an analytical framework to evaluate the relationship between interface design, cognitive workload, and usability outcomes in digital da'wah applications. Unlike prior studies that emphasize content delivery or technological adoption, this research contributes by empirically linking System Usability Scale (SUS) with NASA Task Load Index (NASA-TLX) within a single evaluative framework. This approach strengthens the theoretical and methodological foundation for developing inclusive, cognitively efficient religious digital platforms.

2 Literature Review

2.1 Technological Developments in Da'wah

The spread of Islamic teachings has undergone a significant transformation from traditional face-to-face methods to the use of digital technology, including social media and mobile applications [14, 15]. The use of digital platforms allows for broader outreach, increased congregational engagement, and accelerated information dissemination. Apps like MASJIDA provide easy access for users to attend religious studies, discuss issues, and interact with mosque administrators and preachers, while also taking into account users' technological capabilities, especially those less experienced with digital devices.

2.2 Cognitive Ergonomics in Technology Design

Cognitive ergonomics focuses on how system and interface design affects how users think, understand, and interact with information [16–21]. The goal is to minimize errors, reduce cognitive load, and increase the efficiency of technology use. Research shows that applications that implement cognitive ergonomics principles can improve user experience, reduce confusion, and speed up the learning process for new users [22–26]. In the context of MOSQUE, these principles are applied to ensure that the application can be used easily by a wide range of people, including older users or those less familiar with technology [27].

2.3 The Influence of Application Design on User Experience

Good app design relies not only on functionality but also on user interaction. User interfaces (UI) elements such as intuitive navigation, quick-access buttons, clear notifications, and consistent information layout can improve user experience and ensure effective use [28–31]. The application of cognitive ergonomic principles in MOSQUES aims to reduce mental demand and effort, so that users can focus more on the content of the sermon, not on how to access the application [32, 33]. Thus, ergonomic design increases user engagement and application usage effectiveness.

2.4 Mosque Management through Digital Technology

Digital applications also play a role in mosque management, increasing the efficiency of activity management, accelerating communication between administrators and congregations, and facilitating the distribution of da'wah materials [33, 34]. However, limited digital literacy among administrators demands a simple, intuitive, and easy-to-understand application design. The application of cognitive ergonomics is key to ensuring all users, including those with limited training, can effectively use MASJIDA.

2.5 Research Gaps and Newness

Although numerous studies have addressed the use of technology in da'wah (Islamic outreach), studies on the application of cognitive ergonomics in da'wah applications, particularly for mosque management, are still limited. This study fills this gap by examining how user-focused design elements can optimize the user experience and effectiveness of da'wah dissemination through MASJIDA. MASJIDA's novelty lies in the explicit integration of cognitive ergonomic principles into the interface design, including simplified navigation, visual icons, menu depth limitation, visual cues, and a mobile-first approach. The effectiveness of this design is empirically validated through a combination of SUS and NASA-TLX, making this approach a key contribution of the study.

2.6 Conceptual Model and Theoretical Framework

This study adopts cognitive ergonomics as its primary theoretical lens to explain how interface design characteristics influence user experience outcomes through cognitive processes. Cognitive ergonomics emphasizes the alignment between system design and human cognitive capabilities, particularly attention, working memory, mental workload, and decision-making efficiency. In mobile-based da'wah applications, these cognitive processes directly affect how users perceive usability, interpret information, and maintain engagement during interaction. Accordingly, the conceptual model developed in this study illustrates a causal relationship between interface design elements (navigation simplicity, visual cues, information hierarchy, and interaction consistency), cognitive workload dimensions (mental demand, effort, and frustration), and usability outcomes. Rather than proposing a new theory, this model operationalizes established cognitive ergonomics principles into a practical evaluation framework, allowing empirical assessment through SUS and NASA-TLX instruments, as illustrated in Figure 1.

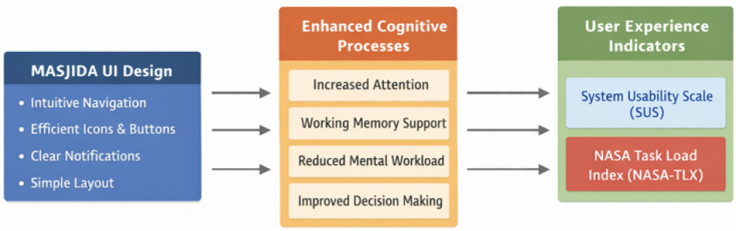

Figure 1. Conceptual cognitive ergonomics model in MASJIDA

3 Methodology

3.1 Research Design

This study employed an experimental pre-test and post-test design. MASJIDA application users, including mosque administrators and congregants, used the application, which was developed based on cognitive ergonomics principles, for approximately two months. Pre-test and post-test evaluations were conducted before and after the usage period to assess changes in usability and cognitive workload. The methodological workflow of the study is illustrated in Figure 2.

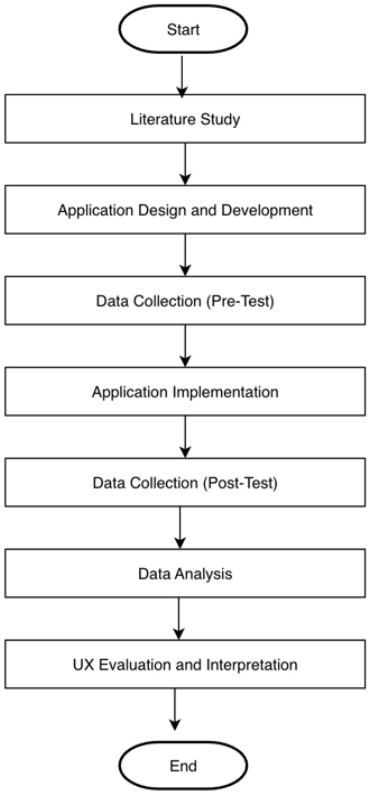

Figure 2. Methodological workflow of the study

3.2 Approach and Data Type

3.2.1 Quantitative data

Quantitative data will be collected through two main instruments: SUS and NASA-TLX.

- SUS is a tool used to measure application usability, with a focus on ease of use, user satisfaction, and overall application effectiveness [28]. SUS is one of the most widely used instruments for assessing user experience and has been proven effective in numerous studies.
- In this study, user cognitive load was measured using the NASA-TLX, a widely used subjective workload assessment instrument. The NASA-TLX measures cognitive load based on six dimensions: mental demand, physical demand, time demand, performance, effort, and frustration level [35, 36].

The SUS and NASA-TLX questionnaires will be administered to users after they have used the application to evaluate their perceptions of the application in terms of usability and cognitive load. The selection of research instruments in this study was based on their relevance, reliability, and widespread use in user experience evaluation and cognitive ergonomics. The SUS was chosen because of its simplicity, high level of validity, and its ability to provide a quick yet reliable overview of the system's usability across various user groups. The SUS is also suitable for comparing usability levels before and after system implementation. The NASA-TLX instrument is used to measure cognitive load because it is able to capture various dimensions of mental effort, such as mental demand, effort, and frustration, which are important indicators in cognitive ergonomics evaluation. This instrument is suitable for assessing the impact of interface design on users' cognitive load while performing tasks. The combination of the SUS and NASA-TLX allows for a comprehensive evaluation of usability and cognitive load, thus providing a more comprehensive user experience assessment from an ergonomics perspective.

3.2.2 Qualitative data

Qualitative data will be collected through in-depth interviews and direct observations. Interviews will be conducted with mosque administrators and congregants to explore their experiences using the MASJIDA app, as well as the challenges they face related to the app's design and implementation of cognitive ergonomics. Direct observations will also be conducted to observe user interactions with the app in a more natural context and to note any issues that may not have been identified through the questionnaire.

3.3 Research Subjects

This study involved 30 participants, consisting of mosque users/congregants and mosque administrators, the primary users of the MASJIDA app. Participants ranged in age from 25 to 55, with intermediate to high levels of digital literacy. All participants had direct experience using the MASJIDA app during the testing period.

The sampling technique used was purposive sampling, with the criteria for participants being individuals actively involved in mosque activities and directly using the MASJIDA application. This method was chosen to ensure that the data obtained truly represents the relevant user experience in the cognitive load evaluation using the SUS and NASA-TLX instruments.

3.4 Data Processing and Analysis

3.4.1 Application development

The MASJIDA application will be designed with cognitive ergonomics principles in mind, aiming to reduce user cognitive load and increase comfort and ease of interaction. The application development process involves application designers and ergonomics experts to ensure that the design meets the needs of diverse users, including those unfamiliar with technology.

3.4.2 Trial and implementation

Once the application is complete, trials will be conducted at several mosques in Batam City. Users, including mosque administrators and congregants, will receive brief training on how to use the application and then be asked to use it in their da'wah activities for a specified period (4–6 weeks). During this period, quantitative and qualitative data will be collected.

3.4.3 Usability testing and cognitive load

- SUS: Users will complete the SUS questionnaire after using the app to rate the app's usability on a Likert scale from 1 (strongly disagree) to 5 (strongly agree). The SUS items will measure ease of use, user satisfaction, and app effectiveness.
- NASA-TLX: Users will be asked to complete the NASA-TLX questionnaire after using the app. This questionnaire will measure various dimensions of perceived cognitive load during app use, including mental demand, physical demand, temporal demand, performance, effort, and frustration levels.

3.4.4 Data analysis

- Quantitative Analysis: Data from the SUS and NASA-TLX questionnaires will be analyzed using descriptive statistics to describe users' general perceptions of the application. Regression analysis will also be conducted to identify the relationship between the application design that integrates cognitive ergonomics and the results of usability measurements and user cognitive load.
- Qualitative Analysis: Interviews and observations will be analyzed using thematic analysis to identify key themes and patterns related to user experience, challenges in app use, and the app's effectiveness in mosque management and da'wah. This analysis will provide in-depth insights into how cognitive ergonomics is applied in app design and its impact on user experience.

4 Results and Discussion

4.1 MASJIDA Application Interface Display

The MASJIDA application is designed with an interface that adheres to the principles of cognitive ergonomics, aiming to reduce cognitive load and simplify user interaction with the application. The MASJIDA interface is designed with large icons that make it easy for users, both mosque administrators and congregants, to access various important features such as activity schedules, announcements, transactions, and da'wah (Figure 3). The simple and intuitive interface design has proven effective in improving usability, according to the results of tests conducted using SUS and NASA-TLX (Figure 4 and Figure 5).

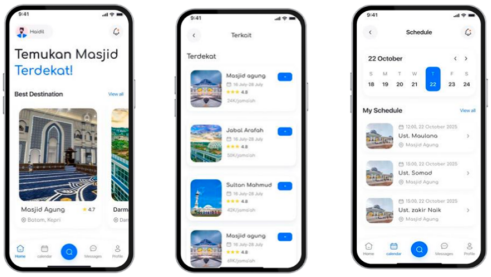

Figure 3. The main user interface of the MASJIDA mobile application is designed based on cognitive ergonomics principles

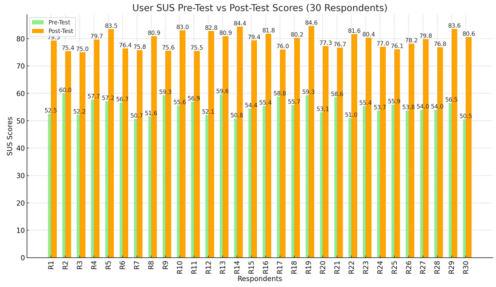

Figure 4. Comparison of SUS scores before and after using the MASJIDA application among users

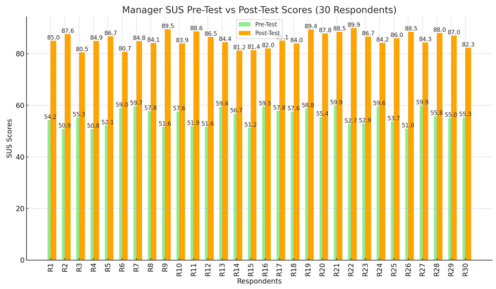

Figure 5. Comparison of SUS scores before and after using the MASJIDA application among mosque managers

4.2 System Design Based on Cognitive Ergonomics

The design of the MASJIDA application based on cognitive ergonomics involves several key design elements aimed at minimizing the user's cognitive load. Elements such as large icons, bottom navigation with 3–5 main icons, and the use of color to clarify status allow users to more easily interact with the application without feeling overwhelmed by excessive information (Table 1). The use of this cognitive load reduction principle has proven successful in increasing the comfort and ease of use of the application, as shown in Figure 5. Significant improvement in SUS scores, with users increasing from 55.1 in the pre-test to 79.3 in the post-test, and mosque managers increasing from 55.5 to 85.4.

Table 1. UI Elements, display descriptions, and cognitive ergonomics analysis

No.	UI Elements	Display Description	Cognitive Ergonomics Analysis & User Experience Impact
1	Home (Dashboard)	Large main icons (Schedule, Announcements, Transactions, Da'wah) with bottom navigation containing 3-5 main icons	Supports rapid visual perception and short-term memory; reduces cognitive load and facilitates access to key information.
2	Mosque Activity Schedule	Schedule list with date and activity type filters and add schedule button	Simplify information retrieval and input; minimize errors and increase interaction efficiency.
3	Mosque Announcement	Announcement list with visual priority and quick sharing options	Speed up decision making and improve visual understanding of information.
4	Da'wah Features	Fundraising information and speaking schedule with direct action buttons	A clear flow of steps reduces user confusion and speeds up cognitive interactions.
5	Transaction Status	Color-based transaction status display with detailed access	Visual cues make monitoring easier and reduce the user's cognitive load.
6	Notifications & Reminders	Compact notification card on dashboard with icon and delivery options	Supports user attention and memory limitations, facilitating timely action taking.
7	Text and Color Display	Minimum text size 14 pt, high contrast, and light/dark mode	Improve visual comfort, accessibility, and readability of information.
8	Button Size & Spacing	Buttons must be at least 44 $\times$ 44 px with adequate spacing between elements.	Supports touch screen interaction and reduces input errors.
9	Language & Labels	Clear and familiar language and consistent labels	Reduces linguistic cognitive load and accelerates comprehension of information.
10	Responsive & Mobile-First	Adaptive layout, stable navigation during rotation	Maintain mental continuity and comfort of use in various device conditions.

Table 1 presents a summary of the MASJIDA interface elements and their respective functions in supporting user interaction. Each UI element is analyzed based on cognitive ergonomics principles, so that each design decision can be linked to the user's relevant cognitive mechanisms. Intuitive menu navigation and quick-access buttons, for example, support reduced cognitive load, while clear notification displays and consistent information layout contribute to accelerated information processing and reduced cognitive errors.

This mapping confirms that interface design focuses not only on aesthetic or functional aspects, but also considers user cognitive factors, including processing efficiency, error minimization, and interaction comfort. Thus, Table 1 serves as a conceptual framework that links interface elements to user cognitive indicators such as mental demand, effort, and frustration, while also providing a scientific basis for interpreting the SUS and NASA-TLX measurement results in the following sections.

4.3 System Testing Results with the Black Box System Method

Functional black-box testing is a standard method in software quality assurance that focuses on verifying that all application functions work according to specifications and are free from critical errors. The MASJIDA Application Testing Scenario and Method can be seen in Table 2. In the development of the MASJIDA application, this stage ensures the stability and integrity of the system before user evaluation. While black-box testing provides confidence that the application is technically functional, this method does not directly measure user perception, interaction efficiency, or cognitive load. Therefore, a scientific evaluation of the user experience was conducted separately using standardized instruments, namely the SUS to assess usability and user satisfaction, and NASA-TLX to assess cognitive load. This approach allows for the integration of functional verification and systematic cognitive assessment, so that the research results can provide a valid and in-depth understanding of the effectiveness, efficiency, and quality of user interaction with cognitive ergonomics-based applications.

Table 2. Scenarios and testing methods for the MASJIDA application

Testing Class	Testing Details	Method
User Registration (Admin & Public)	Register a new account using your full name, email, and valid password.	Black Box
User Login (Admin & Public)	User authentication using registered email and password	Black Box
Addition of Mosque Events	Adding event data via the Activity Schedule menu	Black Box
Additional Announcements	Addition of mosque announcements in the form of titles, content and images	Black Box
Event Data Editing	Changes to saved mosque event data	Black Box
Event Deletion	Deletion of existing mosque event data	Black Box
News Addition	Adding news articles via the News menu	Black Box
News Editing	Changes to the title, content, or image of the news	Black Box
News Deletion	Deletion of existing news data	Black Box
Admin Menu Functionality	Testing the Activity Schedule, Announcements, News, Transaction History submenus, as well as the Add, Edit, Delete, View, and Save button functions.	Black Box
Public User Menu Functionality	Testing the Activity Schedule and Transaction History submenus and the View and Save button functions	Black Box
Profile Editing	Changes to user profile data (name, email, phone number, password, and address)	Black Box
Logout	Testing the function of exiting the system	Black Box
System Usability Evaluation	Assessment of the level of system usability using SUS	SUS

4.4 Test Results with SUS

The SUS test showed a significant improvement in the usability of the MASJIDA application as seen in Figure 4, Figure 5, and Figure 6. This confirms that the application is easy to use and well received by both groups of respondents. This increase is more than 30%, which indicates that the MASJIDA application has succeeded in producing an intuitive and user-friendly interface, in accordance with the excellent usability standard (average score above 80).

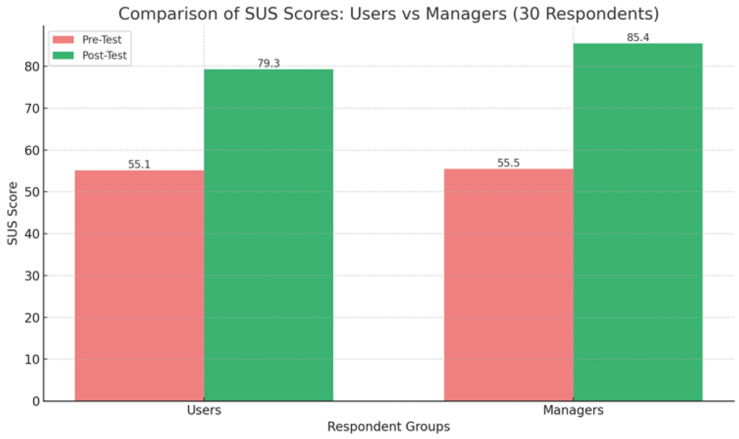

Figure 6. Comparison of post-test SUS scores between users and mosque managers after MASJIDA application implementation

4.5 Cognitive Load Measurement Results with NASA-TLX

These results demonstrate that the cognitive ergonomics-based design successfully reduced users' cognitive load and improved task performance. The NASA-TLX measurement results show that the MASJIDA application successfully reduced the cognitive load experienced by users. Indicators such as Mental Demand, Physical Demand, Effort, and Frustration showed a significant decrease after using the MASJIDA application. For example, Mental Demand (MD) decreased from 68.23 in the pre-test to 35.00 in the post-test. Physical Demand and Effort also experienced a significant decrease, which reflects that this application reduces the difficulty that users usually feel

when interacting with the system.

Table 3 shows a comparison of the average NASA-TLX indicator scores between the pre-test (Manual) and post-test (MASJIDA). The increase in Average WWL from 65.47 (High) in the pre-test to 32.83 (Low) in the post-test indicates that the MASJIDA application has succeeded in significantly reducing cognitive load, making the application more efficient and user-friendly. Figure 7 illustrates this significant change visually, displaying the decrease in cognitive load across various indicators.

Table 3. Comparison of average NASA-TLX scores before (manual system) and after using the MASJIDA application

Indicator	Pre-Test (Manual)	Post-Test (MASJIDA)
Mental Demand	68.23	35.00
Physical Demand	68.14	30.00
Temporal Demand	58.82	32.00
Performance	72.64	38.00
Effort	74.70	34.00
Frustration	50.29	28.00
WWL Average	65.47 (High)	32.83 (Low)

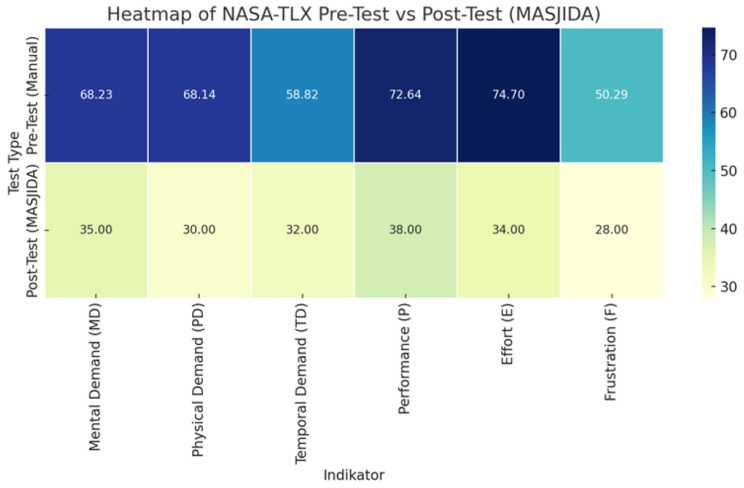

Figure 7. Heatmap comparison of NASA-TLX before and after MASJIDA application usage

Table 2 and Table 3 show a comparison of pre-test (Manual) and post-test (MASJIDA) scores on the SUS and NASA-TLX indicators. In addition to numerical comparisons, significance analysis was performed using a paired t-test, and the magnitude of change was measured by effect size (Cohen's d). The paired t-test results showed a significant increase in SUS scores ($p < 0.05$), with the average user score increasing from 62.3 in the pre-test to 81.7 in the post-test, and the average mosque manager score increasing from 57.5 to 89.5. Cohen's d values indicated a medium to large effect size, confirming that the changes in scores were not only statistically significant but also practically relevant. Analysis of NASA-TLX scores also showed a significant decrease in several dimensions of cognitive load, particularly mental demand and effort ($p < 0.05$), with a medium to large effect size. This decrease indicates a reduction in cognitive demands on users when interacting with the MASJIDA application.

This research analysis not only emphasizes the changes in scores before and after application use, but also the conceptual interpretation of these changes. The decrease in NASA-TLX scores on the dimensions of mental demand, effort, and frustration indicates increased information processing efficiency and reduced cognitive load during interaction with the application. The significant increase in SUS scores, which is associated with reduced cognitive load, indicates that the cognitive ergonomics-based interface design has a positive impact on ease of use, interaction efficiency, and user acceptance. Thus, the results of statistical tests and effect size analysis strengthen the argument that usability improvements do not stand alone, but are correlated with reduced cognitive load. This integrated evaluation approach provides a more comprehensive understanding of the role of cognitive ergonomics in improving the user experience of digital da'wah applications, going beyond simply reporting numerical pre-test and post-test scores. Overall, this study shows that the MASJIDA application, designed with cognitive ergonomics principles, successfully improves usability and reduces user cognitive load.

The improved score can be explained by the application of cognitive ergonomics principles to several of the most impactful UI elements, such as intuitive menu navigation, quick access buttons to mosque activity information, and easy-to-understand notification displays. These elements help reduce mental demand and effort, allowing users to interact more efficiently with the application. Testing results with SUS and NASA-TLX indicate that implementing interface design that takes cognitive ergonomics into account can produce an application that is intuitive, easy to use, and effective in mosque management and da'wah. The increase in the SUS score and the decrease in the NASA-TLX score indicate that this application not only makes it easier for users to access mosque features but also increases congregational engagement and participation in da'wah activities.

Beyond the numerical differences observed in the NASA-TLX scores, these results provide important insights into users' cognitive processing during system interaction. The reduction in mental demand and effort observed in the NASA-TLX results indicates improved cognitive efficiency, suggesting that users were able to process information with lower working memory demands. This finding aligns with cognitive ergonomics theory, which posits that simplified navigation and reduced interface complexity directly contribute to decreased mental workload and improved task performance.

The digital-technology-based MASJIDA application, with a design that prioritizes cognitive ergonomics principles, has proven effective in improving the user experience, which in turn can optimize mosque management and strengthen da'wah. With significant improvements to SUS and NASA-TLX, this application is a potential solution to increase the efficiency and effectiveness of mosque management in the digital era.

The findings of this study were also compared with previous studies that emphasized the importance of cognitive ergonomics and user-centered design approaches in digital application development. The increase in SUS scores in the MASJIDA application is consistent with the results of Jang and Han's study, which showed that the systematic application of a user experience framework can improve user perceptions of usability and satisfaction with digital services [8]. In addition, a significant decrease in cognitive load indicators measured using NASA-TLX, particularly in the mental demand and effort dimensions, reinforces the findings of previous research in the field of cognitive ergonomics by Lesselroth, which states that interface design that considers the user's cognitive processes can effectively reduce cognitive load and improve task performance [9].

In the context of Islamic religious and communication apps, these findings extend previous research on digital da'wah by demonstrating that optimization depends not only on content but also on the quality of interaction and ease of use of the system. Thus, this study provides an additional contribution by connecting cognitive ergonomics and user experience evaluation approaches to the development of digital da'wah apps.

5 Conclusion

This study contributes to the computational and experimental evaluation of human-system interaction by integrating standardized measurement instruments (SUS and NASA-TLX) within an applied cognitive ergonomics framework. Based on the results of testing using SUS and NASA-TLX, this application successfully demonstrated significant improvements in terms of usability and reduced cognitive load for both users and mosque managers.

The SUS test results showed significant improvements in both groups of respondents, with users' scores increasing from 55.1 in the pre-test to 79.3 in the post-test, and mosque managers' scores increasing from 55.5 to 85.4. This confirms that the MASJIDA application, designed with cognitive ergonomics principles in mind, has successfully improved usability and user satisfaction, as well as streamlined mosque management.

The NASA-TLX measurement results showed a significant reduction in cognitive load after using the application. Indicators such as Mental Demand, Physical Demand, Effort, and Frustration showed a significant decrease, reflecting a reduction in the difficulty and confusion experienced by users after implementing the MASJIDA application. This indicates that the cognitive ergonomics-based application design is correlated with a reduction in cognitive workload as well as an improvement in the efficiency of user interaction with the system.

A comparison between the pre-test and post-test showed that the implementation of cognitive ergonomics-based design successfully resulted in an application that was easier to use, more efficient, and more satisfying for users. The decrease in NASA-TLX scores also reflects the application's effectiveness in improving user experience and reducing confusion and frustration that often occurs with more complex systems.

Overall, the results of this study indicate that the MASJIDA application, designed with cognitive ergonomics in mind, has the potential to improve mosque management and the spread of Islamic propagation more effectively and efficiently. This application not only increases user satisfaction but also contributes to facilitating access to Islamic propagation information, increasing congregational engagement, and supporting more organized mosque management activities.

In addition to its empirical contributions, this study also provides practical implications for the development and implementation of digital da'wah applications. For application developers, the results of this study emphasize the importance of applying cognitive ergonomics principles such as simplified navigation, the use of visual cues, and reduced interface complexity in user experience design to accommodate users with varying levels of digital

literacy. For mosque managers, the MASJIDA application demonstrates that an ergonomics-based digital platform can improve management efficiency, streamline communication with congregations, and encourage participation in mosque activities. Meanwhile, for Islamic digital da'wah activities, this study emphasizes that the effectiveness of da'wah technology depends not only on content delivery, but also on ease of use and reduced cognitive load for inclusive and sustainable access. These implications suggest that the application of cognitive ergonomics-based user experience design can be a strategic foundation for the development of digital da'wah platforms in the future.

The primary contribution of this research lies not in developing a new method or model, but in applying an integrated cognitive ergonomics evaluation framework to analyze the relationship between usability and cognitive load in digital da'wah applications. These findings provide conceptual and analytical references for the development of user-oriented digital religious services that are sensitive to users' cognitive limitations.

Although this study shows positive results, there are several limitations that should be considered. First, the sample size was limited to mosque users and managers at several mosques in Batam City, so the generalizability of the results to other regions with different demographic or cultural characteristics is limited. Second, the age and digital literacy levels of respondents have not been analyzed in depth, even though these factors have the potential to influence user experience and cognitive load.

Third, this study did not include comparison systems or other baseline user interfaces (UI). Therefore, the improvement in usability scores and reduction in cognitive load cannot be solely attributed to the cognitive ergonomics-based design. However, the conceptual analysis suggests that UI elements designed according to cognitive ergonomics principles, such as intuitive navigation, quick-access buttons, and clear notifications, play a significant role in facilitating more efficient user interactions. This finding is consistent with the user experience and cognitive ergonomics literature, which emphasizes that implementing cognitive ergonomics principles improves user experience, although further validation with comparisons to other systems or baseline UI would provide more definitive evidence.

Fourth, the evaluation was conducted on a mobile-based platform for a specific period of use, so long-term usability, cross-platform performance, and scalability of the MASJIDA application have not been evaluated. Future research is recommended to involve a broader and more diverse sample, conduct longitudinal evaluations, and develop multi-platform implementations.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

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Conflicts of Interest

The authors declare that they have no conflicts of interest.

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