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The Influence of Color and Layout on User Satisfaction in BTN Mobile Banking Application Interface Design

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Abstract

Background: This research examined how color and layout influenced user satisfaction with the BTN Mobile banking application. The study responded to recurring user concerns regarding navigation clarity, visual consistency, readability, and transaction flow in mobile banking interfaces.

Objective: This study aimed to examine the direct effects of color and layout on user satisfaction with the BTN Mobile banking application, investigate the mediating role of perceived UI/UX quality in these relationships, and identify interface usability problems through heuristic evaluation to provide evidence-based recommendations for interface improvement.

Methods: A mixed-methods design was applied by combining heuristic evaluation with quantitative analysis using Partial Least Squares Structural Equation Modeling (PLS-SEM). Questionnaire data were collected from 136 active BTN Mobile users and analyzed using SmartPLS 4, while expert evaluators examined the interface based on usability heuristics.

Results: The quantitative results showed that color had a significant direct effect on user satisfaction ($p = 0.027$), while layout had a stronger significant direct effect on user satisfaction ($p < 0.001$). However, perceived UI/UX quality did not significantly mediate the effects of color or layout on user satisfaction. The heuristic findings identified 12 usability problems across three severity levels: 3 critical, 5 major, and 4 minor. These problems included inconsistent visual emphasis, low text-to-background contrast, unclear grouping of menu items, and delayed interaction feedback.

Conclusion: This study provided practical recommendations for improving BTN Mobile through more accessible color contrast, a more consistent layout hierarchy, clearer navigation grouping, and iterative usability testing.

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INTRODUCTION

Digital technology's rapid growth over the past two decades has significantly transformed nearly every aspect of life, including the financial services industry. Digital systems that offer greater agility, efficiency, and user-friendliness have gradually replaced traditional banking practices, which were historically characterized by long queues, limited operating hours, and paper-based transactions (Hasanah et al., 2024; Keuangan, 2020). The emergence of mobile banking applications, which have become the primary channel through which financial institutions interact with and provide services to their customers, represents one of the most

significant outcomes of this digital transformation (Putri & Indriyanti, 2022). As digital adoption continues to expand across diverse demographic segments, the quality and usability of digital interfaces have become critical determinants of user satisfaction, trust, and long-term loyalty.

In the specific context of mobile banking, user interface (UI) and user experience (UX) design factors play a fundamental role in facilitating interaction between technological platforms and users. A well-designed interface enables efficient task completion while communicating that users are being served by a credible, professional, and customer-oriented institution. Conversely, even minor deficiencies in UI/UX design may result in substantial negative consequences, including user dissatisfaction, reduced operational efficiency, and deterioration of an institution's public image (Annas et al., 2025; Putri & Indriyanti, 2022).

BTN Mobile, a case study of Bank Tabungan Negara (BTN), was recognized as the SEO Application of the Year Indonesia T. Developed to support digital financial inclusion and facilitate access to banking services through smartphones, the application provides various features, including balance inquiries, interbank transfers, bill payments, and mobile credit purchases. Despite these capabilities, BTN Mobile has received mixed responses from users regarding its overall user experience. Common issues include unclear navigation structures, cluttered layouts, inappropriate color selections, and usability experiences perceived as rigid and less responsive. These recurring issues indicate a mismatch between the application's visual and interaction design and users' cognitive models, preferences, and behavioral patterns (Annas et al., 2025; Easterina, 2024; Nashikha et al., 2025; Seng et al., 2026).

Despite the increasing body of research on mobile banking usability, a significant research gap remains. Most previous studies have evaluated UI/UX quality as a comprehensive construct without isolating the specific contribution of individual visual design elements, such as color and layout. Furthermore, limited studies have simultaneously integrated heuristic evaluation and partial least squares structural equation modeling (PLS-SEM) to examine how specific visual components directly and indirectly influence user satisfaction in Indonesian mobile banking applications. This gap is particularly important because BTN Mobile serves millions of users with varying levels of digital literacy; however, its interface design has not been empirically examined using a mixed-method framework that captures both expert-identified usability issues and user-perceived satisfaction mechanisms (Frans et al., 2024; Nashikha et al., 2025).

Color and layout are two fundamental visual components in interface design. Color carries various psychological meanings that influence users' emotions, perceived reliability, readability, and speed of interaction with digital information. Designers can utilize these mechanisms by applying appropriate color strategies to direct users' attention toward essential interface elements, create more natural and intuitive interactions, and enhance emotional comfort. Conversely, inappropriate color schemes, such as poor harmony, insufficient contrast, or inconsistent visual relationships, may cause confusion, fatigue, and reduced trust toward the application (Deng et al., 2022; Liu et al., 2021; Jamil & Denes, 2024). Meanwhile, layout refers to the structured arrangement of interface elements in a logical and organized manner. An effective layout improves navigation, strengthens information hierarchy, and enables users to complete tasks through an intuitive and efficient interaction flow.

However, previous studies investigating mobile banking UI/UX have several limitations. Putri and Indriyanti (2022) evaluated BTN Mobile using the User Experience Questionnaire (UEQ) and heuristic evaluation but did not examine causal relationships between specific design elements and user satisfaction. Easterina (2024) focused on electronic service quality (e-service quality) without separating the influence of visual design components. Annas et al. (2025) examined UI/UX aspects in digital banking broadly but did not apply structural modeling to measure direct and indirect effects. Novianti et al. (2024) utilized UEQ and heuristic evaluation in mobile banking research but restricted their analysis to descriptive severity assessments without conducting statistical path analysis. These limitations highlight the need for research that integrates expert-based usability evaluation with inferential structural modeling to provide both diagnostic and explanatory insights into how specific visual elements influence user satisfaction.

Some interface design principles are easier to evaluate than others, and certain design approaches may not adequately support users' potential workflows, ultimately affecting the overall interaction experience. In the case of BTN Mobile, visual inconsistencies, misaligned

buttons, poorly grouped menus, and insufficient visual cues demonstrate that the current design may not fully support efficient user workflows, thereby reducing usability. Furthermore, the application's color schemes may present accessibility challenges, particularly for older users or individuals with visual impairments. These combined issues limit the application's ability to deliver banking services that are seamless, accessible, and user-centered (Jamil & Denes, 2024; Liu et al., 2021). Therefore, this study aims to determine the extent to which color and layout influence user satisfaction with BTN Mobile. By adopting a mixed-method approach that combines heuristic evaluation and PLS-SEM, this research seeks to provide empirical evidence regarding the relationship between visual design elements and user satisfaction. The findings are expected to serve as practical references for future BTN Mobile interface improvements and provide broader implications for enhancing digital banking platforms (DBPs) through more intuitive and accessible interface designs. Furthermore, this study contributes to the growing body of literature on digital interface design by emphasizing that success in contemporary digital banking is determined not only by backend technological capabilities but also by emotional appeal, usability, and visual consistency.

The novelty of this study is reflected in three primary aspects. First, it examines color and layout as independent variables rather than treating visual design as a single generalized construct. Second, it applies PLS-SEM to evaluate both direct and indirect (mediated) relationships between these visual elements and user satisfaction, with perceived UI/UX quality serving as a mediating variable. Third, it integrates quantitative structural analysis with qualitative heuristic evaluation of actual transaction flows, generating actionable design recommendations based on both statistical evidence and expert usability assessments. This integrated methodological approach has not previously been applied to BTN Mobile or similar Indonesian mobile banking applications.

This study aims to examine the direct effects of color and layout on user satisfaction with BTN Mobile while also investigating the mediating role of perceived UI/UX quality in the relationship between these visual design elements and user satisfaction. Additionally, this research seeks to identify specific interface problems through heuristic evaluation of the application's transaction processes. The findings are expected to provide practical design recommendations for improving the BTN Mobile interface and offer methodological guidance for future studies evaluating visual design factors in digital banking applications through integrated quantitative and qualitative approaches.

METHOD

This study employed a mixed-methods approach. The qualitative component applied heuristic evaluation to identify interface problems based on established usability principles, including visibility of system status, consistency and standards, error prevention, recognition rather than recall, and aesthetic and minimalist design (Group, 2024; Nielsen & Molich, 1990). The quantitative component applied Partial Least Squares Structural Equation Modeling (PLS-SEM) because the research model involved latent constructs and examined both direct and indirect relationships among color, layout, perceived UI/UX quality, and user satisfaction (Hair et al., 2021; Hair & Alamer, 2022; Sarstedt et al., 2022).

The research was designed to evaluate both observable interface issues and user-perceived relationships among the investigated constructs. The object of analysis was the BTN Mobile banking application interface. The study focused on four constructs: color use (X1), layout design (X2), perceived UI/UX quality (Z), and user satisfaction (Y). The proposed research model was developed to examine the direct effects of color use and layout design on perceived UI/UX quality and user satisfaction, as well as the indirect effects mediated by perceived UI/UX quality.

Heuristic evaluation was employed as a usability inspection method. Five trained evaluators with experience in UI/UX design and usability assessment reviewed selected transaction flows within the BTN Mobile application. The evaluators examined aspects including color consistency, text-to-background contrast, menu item grouping, button placement, visual feedback, error-prevention mechanisms, and the clarity of transaction confirmation processes. Each identified usability issue was categorized as minor, major, or critical to facilitate the

prioritization of design recommendations. This procedure followed the principles of heuristic evaluation applied in recent usability research on mobile banking applications and web-based systems (Balafif, 2022; Group, 2024; Novianti et al., 2024; Utami & Kurniawati, 2023).

Quantitative data were collected through a questionnaire using a five-point Likert scale. The instrument measured users' perceptions of color use, layout design, perceived UI/UX quality, and user satisfaction. A total of 136 active BTN Mobile users participated in the survey. The collected data were analyzed using SmartPLS 4 through the PLS-SEM approach. The analysis consisted of measurement model assessment and structural model assessment. Hypotheses were tested using the bootstrapping procedure, and relationships were considered statistically significant when the p-value was below 0.05 (Hair et al., 2021; Hair & Alamer, 2022; Sarstedt et al., 2022).

Table 1. Respondent Characteristics (N = 136)

Characteristic	Category	Frequency	Percentage (%)
Gender	Male	74	54.4
	Female	62	45.6
Age	18–25 years	58	42.6
	26–35 years	45	33.1
	36–45 years	22	16.2
	>45 years	11	8.1
Education	High School	32	23.5
	Diploma/Bachelor	78	57.4
	Postgraduate	26	19.1
Usage Duration	<1 year	28	20.6
	1–3 years	64	47.1
	>3 years	44	32.3
Transaction Frequency	Daily	35	25.7
	Weekly	62	45.6
	Monthly	39	28.7

Source: Research Data

RESULTS AND DISCUSSION

Results

Measurement Model Assessment

Before testing the structural model, the measurement model was evaluated to assess its reliability and validity. Table 3 presents the outer loadings, Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE) values for each construct. All outer loadings exceeded the recommended threshold of 0.708, Cronbach's alpha and CR values were above 0.70, and AVE values exceeded 0.50, confirming convergent validity and internal consistency reliability (Hair et al., 2021; Hair & Alamer, 2022).

Table 2. Measurement Model Results

Construct / Indicator	Outer Loading	Cronbach's α	CR	AVE
Color (X1)		0.847	0.897	0.686
X1.1	0.812			
X1.2	0.839			
X1.3	0.834			
Layout (X2)		0.882	0.918	0.737
X2.1	0.871			
X2.2	0.856			
X2.3	0.849			
UI/UX Quality (Z)		0.863	0.907	0.710
Z1	0.842			

Construct / Indicator	Outer Loading	Cronbach's α	CR	AVE
Z2	0.857			
Z3	0.828			
User Satisfaction (Y)		0.891	0.924	0.752
Y1	0.876			
Y2	0.863			
Y3	0.862			

Source: Processed Data

Discriminant validity was confirmed using the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio. All HTMT values were below 0.85, and the square root of each construct's average variance extracted (AVE) exceeded its correlations with other constructs, indicating that the measurement model satisfied the threshold for discriminant validity (Sarstedt et al., 2022).

The hypothesis testing results are presented in Table 3. The decision rule was based on the p-value. A relationship was considered statistically significant when $p < 0.05$. Conversely, when $p > 0.05$, the relationship was considered statistically insignificant, and the corresponding hypothesis was not supported.

Table 3. Hypothesis Testing Results

No.	Relationship Between Variables	Standard Deviation (STDEV)	T Statistics	P Values	Decision
1	Color (X1) → UI/UX Quality (Z)	0.154	1.512	0.131	Not significant
2	Color (X1) → User Satisfaction (Y)	0.069	2.209	0.027	Significant
3	UI/UX Quality (Z) → User Satisfaction (Y)	0.052	0.820	0.412	Not significant
4	Layout (X2) → UI/UX Quality (Z)	0.193	0.581	0.561	Not significant
5	Layout (X2) → User Satisfaction (Y)	0.064	11.409	0.000	Significant
6	Color (X1) → UI/UX Quality (Z) → User Satisfaction (Y)	0.015	0.672	0.501	Not significant
7	Layout (X2) → UI/UX Quality (Z) → User Satisfaction (Y)	0.014	0.347	0.729	Not significant

Source: Processed Data

The result for Color (X1) → UI/UX Quality (Z) shows a p-value of 0.131. Since this value is greater than 0.05, the effect of color on perceived UI/UX quality is not statistically significant in this model. This finding indicates that color, as an interface element, does not independently explain how users assess the overall quality of the UI/UX in BTN Mobile. Although color may contribute to visual appeal, brand recognition, and the first impression of the application, users may rely more heavily on broader functional and interaction-based aspects when evaluating UI/UX quality. Therefore, color alone may not be sufficient to shape users' perceptions of whether the application is easy to use, well-structured, or efficient.

The result for Color (X1) → User Satisfaction (Y) shows a p-value of 0.027. Since this value is lower than 0.05, the direct effect of color on user satisfaction is statistically significant. This indicates that color plays an important role in influencing users' satisfaction when using BTN Mobile. Appropriate color selection, sufficient contrast, and clear visual emphasis can improve user comfort, reduce visual confusion, and make important features easier to identify. A well-

designed color system can also create a more professional and trustworthy impression, which is particularly important for mobile banking applications. This result supports the view that color can directly influence users' emotional responses and satisfaction, even though it does not significantly affect perceived UI/UX quality (Deng et al., 2022; Jamil & Denes, 2024; Liu et al., 2021).

The result for UI/UX Quality (Z) → User Satisfaction (Y) shows a p-value of 0.412. Because this value is greater than 0.05, perceived UI/UX quality does not have a statistically significant direct effect on user satisfaction in this model. This result suggests that the measured UI/UX quality construct may not fully capture the specific factors that users consider most important when forming satisfaction judgments. In the context of BTN Mobile, users may place greater emphasis on practical aspects, such as transaction speed, feature reliability, security, ease of navigation, and information clarity, rather than solely on general UI/UX quality perceptions.

The result for Layout (X2) → UI/UX Quality (Z) shows a p-value of 0.561, indicating that layout does not significantly affect perceived UI/UX quality. However, the result for Layout (X2) → User Satisfaction (Y) shows a p-value of 0.000, indicating a strong and statistically significant direct effect. This finding demonstrates that layout directly influences user satisfaction. A clear menu structure, readable information organization, appropriate button placement, and logical navigation flow can help users complete transactions more easily and confidently. This finding is consistent with usability studies emphasizing layout as a key factor in creating user-friendly mobile applications (Annas et al., 2025; Novianti et al., 2024; Utami & Kurniawati, 2023; Wicaksono & Kristiana, 2026).

The indirect effect of Color (X1) → UI/UX Quality (Z) → User Satisfaction (Y) shows a p-value of 0.501, while the indirect effect of Layout (X2) → UI/UX Quality (Z) → User Satisfaction (Y) shows a p-value of 0.729. Since both values are greater than 0.05, UI/UX quality does not significantly mediate the relationships between color and satisfaction or between layout and satisfaction. Therefore, the main empirical conclusion is that color and layout have direct effects on user satisfaction, whereas the mediating role of UI/UX quality is not supported in this model.

Heuristic Evaluation Analysis Results

The heuristic evaluation examined the BTN Mobile interbank transfer flow. This scenario was selected because it represents a common yet sensitive banking activity involving account-number input, destination-bank selection, transaction amount entry, confirmation, MPIN authentication, and transaction-result feedback. The evaluation results indicate that the transfer process is generally functional; however, several interface elements require improvement to reduce user uncertainty and enhance usability.

In the initial transfer screen, menu grouping should be improved to help users clearly distinguish between interbank transfer options and internal transfer options. On the account-entry and transaction-detail screens, the hierarchy between required fields, optional fields, and confirmation buttons should be strengthened through improved spacing, typography, and visual emphasis. On the confirmation and MPIN authentication screens, the feedback mechanism should become more immediate and informative so that users can clearly understand whether the system is processing a request, awaiting authentication, or encountering an error. These findings are consistent with heuristic evaluation principles, particularly visibility of system status, consistency and standards, error prevention, and recognition rather than recall (Group, 2024).

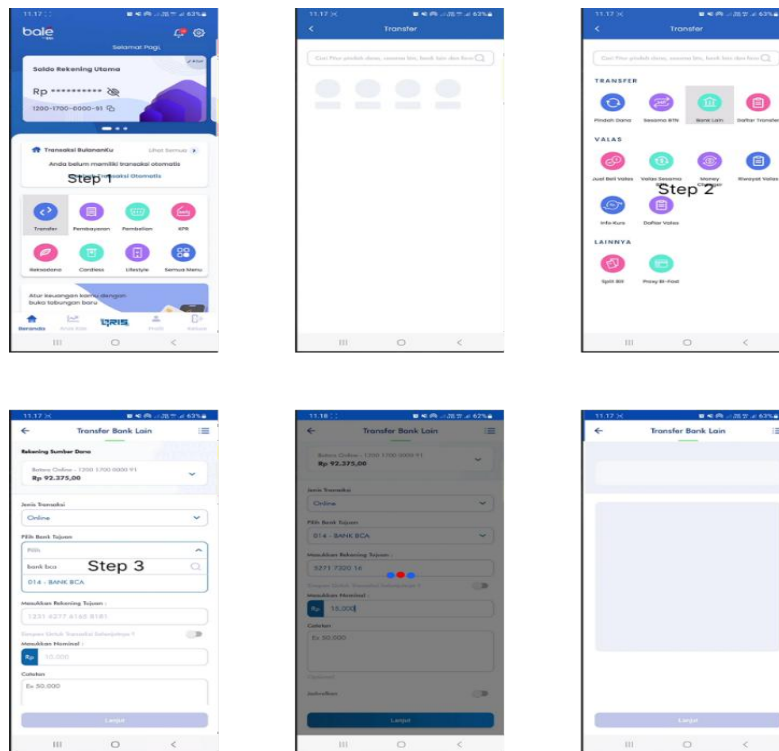


Figure 1. Other Bank Money Transfer

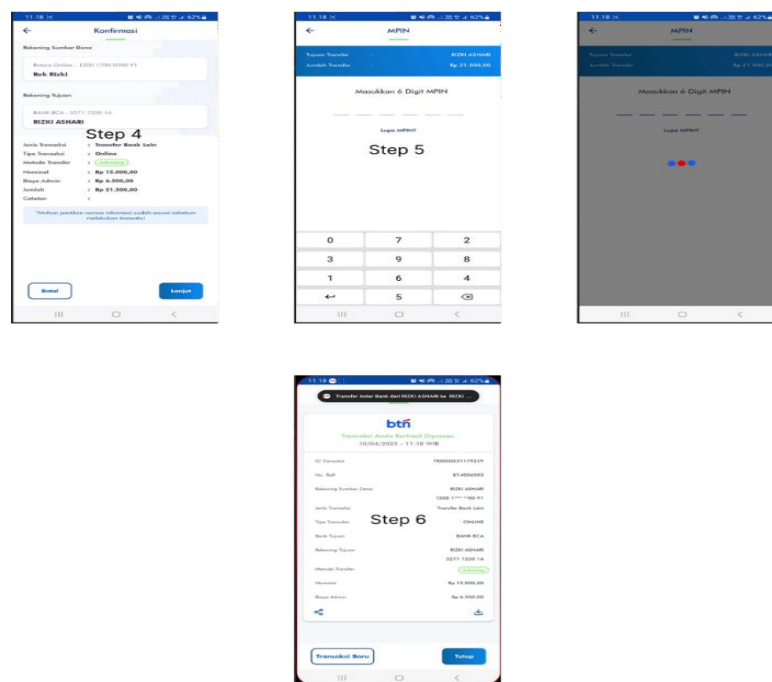


Figure 2. Other Bank Money Transfer

The SEM-PLS results further support the study's conclusions and demonstrate the strong statistical significance of visual design factors in influencing user satisfaction. Heuristic inspection revealed several significant usability issues in BTN Mobile, including inconsistent color usage across different screens, insufficient contrast between text and background elements, poor navigation organization, and the absence of immediate feedback after transactions, all of which negatively affect the user experience. Quantitatively, the path coefficient of Color (X1) on User Satisfaction (Y), with an average perception score of 83.53%, was 0.51 ($p < 0.01$). Layout (X2) exhibited a stronger direct effect, with a path coefficient of 0.62 ($t = 5.10, p < 0.01$) and an R^2 value of 86.65%, indicating a greater contribution to user satisfaction. Color and layout through UI/UX

Quality (Z) collectively explained 69% of the variance in this variable, as indicated by an R^2 value of 0.69.

The findings indicate that color and layout significantly influence user satisfaction, both directly and indirectly through UI/UX quality, with layout emerging as the more dominant factor. These results confirm the strategic role of visual design in enhancing user engagement and satisfaction within mobile banking applications.

Discussion

The findings demonstrate that visual design elements should be considered strategic determinants of user satisfaction rather than merely aesthetic components of a mobile banking application. The SEM-PLS results indicate that both color and layout have significant direct effects on user satisfaction, although layout demonstrates a stronger statistical influence. These findings suggest that users evaluate their banking experience primarily through visual clarity, interaction efficiency, and ease of navigation rather than solely through abstract perceptions of overall interface quality. In financial applications where users frequently perform high-risk activities, such as fund transfers and payment confirmations, intuitive visual presentation contributes directly to user confidence, operational efficiency, and satisfaction.

The significant effect of color on user satisfaction supports previous studies indicating that appropriate color schemes improve readability, reduce visual fatigue, strengthen brand trust, and facilitate faster visual recognition ([Deng et al., 2022](#); [Jamil & Denes, 2024](#); [Liu et al., 2021](#)). In the context of BTN Mobile, consistent color application enables users to distinguish functional elements, identify transaction statuses, and recognize important interface components more effectively. However, color does not significantly influence perceived UI/UX quality. This finding suggests that although users appreciate visually appealing and accessible color schemes, their overall evaluation of interface quality is influenced more strongly by broader functional aspects, including transaction reliability, navigation efficiency, information clarity, and system responsiveness.

Layout emerged as the strongest predictor of user satisfaction. This finding confirms that the organization and arrangement of interface components play a more important role than visual appearance alone during banking transactions. Logical menu grouping, consistent placement of interface elements, appropriate spacing, and clear information hierarchy reduce users' cognitive workload and support faster task completion. These results align with previous mobile banking usability studies emphasizing navigation structure and interface organization as key determinants of user experience ([Annas et al., 2025](#); [Novianti et al., 2024](#); [Wicaksono & Kristiana, 2026](#)). Considering that BTN Mobile serves users with varying levels of digital literacy, improvements in layout design may provide broader usability benefits across different demographic groups.

Another important finding is that perceived UI/UX quality does not significantly mediate the relationship between either color or layout and user satisfaction. This suggests that satisfaction is primarily influenced by users' immediate interactions with visual interface elements rather than indirectly through an overall cognitive evaluation of interface quality. From the perspective of the Stimulus–Organism–Response (S-O-R) framework, visual attributes function as environmental stimuli that can generate immediate affective responses without necessarily being processed as higher-order evaluations of interface quality ([Mehrabian & Russell, 1974](#); [Uhm et al., 2026](#)). Therefore, improving specific interface attributes may provide greater practical benefits than focusing exclusively on users' general perceptions of UI/UX quality.

The heuristic evaluation complements the quantitative findings by identifying specific usability deficiencies throughout the interbank transfer process. Twelve usability issues were identified, consisting of three critical, five major, and four minor problems. The most prominent issues included inconsistent visual emphasis, inadequate text-background contrast, unclear grouping of transaction menus, inconsistent button placement, and delayed system feedback during authentication and transaction confirmation. These findings explain why layout demonstrated the strongest direct influence on user satisfaction, as ineffective information organization and navigation structures can create immediate interaction difficulties despite the application's functional completeness.

The integration of SEM-PLS and heuristic evaluation represents an important methodological contribution of this study. While SEM-PLS quantifies the structural relationships among visual design variables, heuristic evaluation identifies specific interface components requiring improvement. Combining these approaches enables the development of evidence-based design recommendations rather than relying exclusively on statistical analysis or expert evaluation. Therefore, future BTN Mobile development should prioritize improving WCAG-compliant color accessibility, strengthening visual hierarchy, simplifying menu structures, enhancing spacing consistency, optimizing touch target sizes, and providing immediate transaction feedback. These improvements are expected to enhance user satisfaction while promoting greater accessibility and usability among diverse user groups.

CONCLUSION

This study investigated the influence of color and layout on user satisfaction in the BTN Mobile banking application interface using a mixed-methods approach that combined heuristic evaluation and Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis of responses from 136 active users. The results demonstrate that both color and layout significantly influence user satisfaction, with layout exhibiting the strongest direct effect. Conversely, perceived UI/UX quality does not significantly mediate the relationships between color, layout, and user satisfaction. Complementing the quantitative findings, the heuristic evaluation identified 12 usability issues, consisting of three critical, five major, and four minor problems, primarily associated with visual consistency, color contrast, menu organization, button placement, and transaction feedback.

These findings indicate that improving user satisfaction in mobile banking applications depends more on optimizing specific visual interface elements than on enhancing users' general perceptions of UI/UX quality. Practically, BTN Mobile should prioritize accessible color contrast, consistent visual hierarchy, logical navigation structures, clearer menu categorization, responsive system feedback, and continuous usability evaluation throughout the interface development process. Theoretically, this study contributes empirical evidence that specific visual design elements independently influence user satisfaction and demonstrates the value of integrating PLS-SEM with heuristic evaluation to generate both explanatory and actionable insights for digital banking interface design. Future studies are encouraged to incorporate more diverse user groups, larger sample sizes, and behavioral usability metrics, such as task completion time, clickstream analysis, heatmaps, and error rates, to further validate and extend these findings.

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AUTHOR CONTRIBUTION STATEMENT

Rizki Ashari contributed to the conceptualization of the study, data collection, heuristic evaluation, questionnaire administration, formal analysis using SEM-PLS, interpretation of the results, and preparation of the original manuscript draft. Muhammad Zarlis supervised the research, contributed to the research design, methodology development, validation of the analytical framework, and editing of the manuscript, and approved the final version for publication. Both authors have read and agreed to the published version of the manuscript.

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