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User-Centered Mobile Navigation: Evaluating Local Usability for Improved UX

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Abstract
Mobile navigation interfaces continue to face persistent usability challenges, particularly when widely accepted design conventions fail to address the specific needs and mental models of local user populations. This research addresses this gap by applying a qualitative multi-method, user-centered evaluation framework to identify and analyze context-dependent navigation problems in mobile applications. The study employed User-Centered Design (UCD) combined with heuristic evaluation, using in-depth questionnaires, semi-structured interviews, and laboratory-based usability testing with 15 participants interacting with a Figma prototype simulating real-world navigation tasks. The findings revealed measurable usability limitations, reflected in a 73% task completion rate and an average error score of 2.8 across core navigation tasks. The dominant issues identified were ambiguous iconography, inconsistent application of platform design patterns, and insufficient system feedback mechanisms. These results demonstrate that localized usability testing is not merely beneficial but essential for developing mobile interfaces that are both effective and accessible. Furthermore, the study offers practical, immediately applicable design recommendations, including the integration of descriptive text labels for icons and real-time visual feedback mechanisms. Overall, the findings emphasize the strategic importance of context-aware usability evaluation in improving mobile navigation performance while maintaining practical feasibility for diverse development environments.

Keywords: *User-Centered Design, Mobile Navigation, Usability Evaluation, Local Context.*

I. INTRODUCTION

Mobile applications are now central to daily life, yet many widely used navigation patterns remain misaligned with the mental models and interaction habits of specific local user groups. This mismatch causes users to experience confusion, inefficiency, and ultimately abandonment when performing otherwise simple tasks, creating a clear practical problem for designers and developers of mobile interfaces. Such usability gaps are particularly critical because effective navigation directly affects user retention, satisfaction, and perceived app quality. The primary objective of this study is to uncover and examine specific usability problems in mobile navigation from the perspective of local users, using a localized, user-centred evaluation approach.

To address this problem, this research applies a lean, qualitative, multi-method UCD approach that combines questionnaires, semi-structured interviews, heuristic inspection, and laboratory-based usability testing on a clickable prototype to surface context-dependent navigation issues and measurable performance outcomes (Al-Hunaiyyan et al., 2021). The goals are (1) to identify the dominant usability breakdowns that impede efficient navigation for the target local population

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and (2) to generate actionable design recommendations that are feasible for typical development teams. This approach aligns with the shift from early usability engineering toward experience-oriented design that emphasizes meaning, engagement, and ease of interaction (Quaresma et al., 2022). By focusing on local context, this study goes beyond general guidelines to explore practical, culturally relevant solutions.

Rather than enumerating every prior study, the literature is synthesized into three analytical insights that motivate this work. First, global usability frameworks such as heuristic principles provide valuable high-level guidance but frequently lack the cultural and contextual granularity required for effective local adoption (Abuaddous et al., 2022). Second, previous UCD-based studies in domains such as healthcare and e-commerce show the strength of participatory design, yet they often prioritize system functionality over fine-grained interaction components like navigation (Bonet-Olivencia et al., 2024; Gunawan et al., 2021; Hamdanuddinsyah et al., 2023; Wang et al., 2022). Third, large-scale or automated UX evaluations are efficient for detecting surface-level issues but tend to overlook subtle, culturally rooted misunderstandings of icons, labels, and feedback that only emerge through localized, in-person testing (MacDonald et al., 2022; Perrig et al., 2024). These insights collectively highlight a research gap: robust empirical evidence on how navigation design performs in local contexts remains limited.

Our contributions are twofold. Empirically, we document navigation performance for a local user sample and quantify key outcomes, including task completion and error patterns. In practice, we present a compact, repeatable UCD workflow that development teams can adopt to reveal and remediate context-specific navigation failures without requiring large-scale experimental infrastructure. This workflow demonstrates that meaningful, context-aware usability evaluation is achievable even with lean resources. This study aims to identify and analyze context-dependent usability issues in mobile navigation systems through localized, user-based testing.

II. LITERATURE REVIEW

A. UCD in Local Context

User-Centered Design (UCD) is a design approach where users' needs and limitations guide all stages of interactive prototype development and evaluation. This philosophy ensures that products align with user capabilities, resulting in meaningful and satisfying experiences (Quaresma et al., 2022). The application of UCD has been widely demonstrated across domains, including healthcare, where patient-centered approaches significantly improve usability outcomes (Gilbert, 2022). In this study, UCD serves as the methodological foundation for examining mobile navigation within local user attitudes and environments, building on prior work that applied UCD in at-risk populations (Bonet-Olivencia et al., 2024) and in mobile application contexts (Wira et

al., 2024). By centering users in the design process, the study ensures that both method and findings are directly relevant to the specific local population under investigation.

B. Cross-cultural usability

While UCD defines the process, research on cross-cultural usability emphasizes that global principles do not work uniformly. Studies show that local context cultural norms, cognitive models, and technology exposure strongly affects user perception and interaction (Abuaddous et al., 2022; Miraz et al., 2022). Prior work in healthcare and financial applications (Hamid et al., 2022; Mubeen et al., 2021) demonstrates the value of usability testing but often aggregates results across broad populations, potentially masking culturally rooted interaction patterns. These insights underscore the necessity of context-sensitive evaluation for navigation systems, which are often underexplored in localized studies. Understanding cross-cultural differences clarifies why some navigation patterns fail for specific user groups, thereby justifying the localized focus of this study.

Table 1 presents key previous research on usability and UX evaluation. Rather than only listing studies, the table serves an analytical function: it highlights patterns, methodological approaches, and gaps that justify the current study's focus on context-specific navigation evaluation.

Table 1. Overview of Previous Research on Usability and UX Evaluation

Researcher(s) (Year)	Methodology	Key Findings	Limitations / Contextual Gap
(Abuaddous et al., 2022)	Analysis of automated UX testing	Automated tools are efficient but lack depth in identifying nuanced, contextual user pain points.	Findings are tool-focused; lacks deep qualitative insight into specific user groups.
(Aldi & Wahyuddin, 2022)	User-Centered Design (UCD) application	UCD process successfully improved the usability of a web-based sales system.	Focus was on the overall system design, not on a targeted evaluation of a single component, such as navigation.
(Miraz et al., 2022)	Cross-cultural usability evaluation	Cultural background significantly influences users' perceptions and interactions with adaptive interfaces.	Study focused on AI-based adaptation, not on the static structural elements of navigation.
(Mubeen et al., 2021)	Usability evaluation of healthcare apps	Identified critical usability flaws affecting task completion in high-stakes environments.	Focused on a specific, high-stakes domain; findings may not translate directly to general consumer apps.
(Hamid et al., 2022)	Usability testing of mobile banking apps	Highlighted the importance of trust and efficiency in financial application UX.	User base was treated as a monolithic "emerging economy" group, potentially masking local subtleties.

C. Heuristic-based evaluation

Usability heuristics provide concrete criteria for evaluating interactive systems, including learnability, efficiency, memorability, error prevention, and satisfaction. Nielsen's Heuristics, widely applied in web and mobile systems, identify issues such as visibility of system status, real-world correspondence, and user control (Azizi et al., 2021; Ilyas et al., 2022). In this study, heuristics are applied analytically to decompose user interactions and pinpoint friction points in mobile navigation that broader evaluations often overlook. Previous applications of heuristics in healthcare and government systems demonstrate their ability to reveal hidden usability issues (Azizi et al., 2021; Ilyas et al., 2022). Combining heuristic evaluation with localized UCD methods strengthens the analysis, ensuring both systematic rigor and contextual relevance.

D. Research gap

Most prior studies focus on general UCD effectiveness, while localized, navigation-specific usability evaluations remain underexplored. Although UCD and heuristic frameworks are widely applied (Perrig et al., 2024; Puji & Engraini, 2021; Wronikowska et al., 2021), research rarely integrates these methods for focused, context-aware analysis of core UI components. Existing studies either evaluate entire systems or general UX, lacking fine-grained assessment of navigation in specific local populations. This study addresses this gap by employing a lean, qualitative approach that prioritizes depth over scale and investigates real user experiences in their local environment. By doing so, the research provides actionable insights into navigation usability that are rarely captured in broader studies.

E. Conceptual Framework

The conceptual model for this study is presented in Figure 1. From Figure 1, it is theorized that theoretical premises inform context-specific navigation usability evaluation processes, incorporating local users in their usual contexts to yield empirical findings for UX optimization and usable design heuristics applicable in similar environments. This framework positions UCD and Nielsen's Heuristics as cornerstones while addressing the lack of context-specific assessment of navigation interactions. Measurement and evaluation are guided by surveys, interviews, and usability tests, translating abstract theory into a practical research design.

Figure 1. Conceptual Framework for Context-Specific Mobile Navigation Usability Evaluation

III. RESEARCH METHOD

The research utilizes a qualitative approach to evaluate user-centered mobile navigation. It aims to provide a richly contextualized picture of user behavior through exploratory analysis of usability issues rather than quantification of known metrics. This approach is particularly suitable for understanding the 'why' behind users' behavior and frustration, which may not be captured through quantitative methods (Meyer et al., 2021; Perrig et al., 2024). The study is a descriptive single-case study focused on a single mobile navigation feature, enabling in-depth observation in a natural setting. Design is guided by User-Centered Design (UCD) principles, emphasizing iterative user input at every stage of interface development (Bonet-Olivencia et al., 2024; Wira et al., 2024). By prioritizing direct user interaction over complex experiments, actionable feedback can be collected to drive incremental interface improvements (Abuaddous et al., 2022).

The study targeted adult mobile app users from a specified local community, forming a homogeneous population segment suitable for identifying localized usability patterns. Purposive sampling was used to recruit 15 frequent smartphone users, ensuring participants had relevant experience with day-to-day mobile navigation tasks (Meyer et al., 2021). Table 2 presents their demographic profile, highlighting diversity across age, occupation, and primary app usage,

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providing rich insights into navigation behaviors. This heterogeneity allows findings to reflect patterns that are not idiosyncratic to a single user type but applicable to the wider community (Perrig et al., 2024). For instance, comparing a high-frequency social media user with a banking-heavy user revealed complementary insights into interface expectations and mental models.

Table 2. Participant Demographic Profile (N=15)

Participant ID	Age Range	Gender	Occupation	Smartphone Usage Frequency	Primary App Types Used
P01	18-25	Female	Student	High (4-5 hrs/day)	Social Media, Education
P02	26-35	Male	Engineer	Very High (>5 hrs/day)	Productivity, News
P03	36-45	Female	Teacher	Medium (2-3 hrs/day)	Communication, Banking
P04	18-25	Male	Student	Very High (>5 hrs/day)	Social Media, Entertainment
P05	46-55	Female	Manager	Medium (2-3 hrs/day)	Banking, E-commerce
P06	26-35	Female	Designer	High (4-5 hrs/day)	Productivity, Social Media
P07	36-45	Male	Consultant	High (4-5 hrs/day)	News, Travel
P08	18-25	Female	Freelancer	Very High (>5 hrs/day)	E-commerce, Social Media
P09	26-35	Male	Accountant	Medium (2-3 hrs/day)	Banking, Productivity
P10	46-55	Male	Entrepreneur	High (4-5 hrs/day)	E-commerce, Communication
P11	18-25	Non-binary	Student	Very High (>5 hrs/day)	Entertainment, Social Media
P12	36-45	Female	Administrator	Medium (2-3 hrs/day)	Communication, E-commerce
P13	26-35	Female	Developer	Very High (>5 hrs/day)	Productivity, Utilities
P14	46-55	Male	Retired	Low (1-2 hrs/day)	News, Communication
P15	26-35	Female	Marketer	High (4-5 hrs/day)	Social Media, E-commerce

Note: Usage Frequency was self-reported by participants during the initial demographic survey.

Primary data were collected using a multi-method approach to maximize triangulation and validity. Sources included participants' behavior, spontaneous remarks, and emotional reactions during sessions. Data collection proceeded in three phases: demographic questionnaire, semi-structured interviews (Zulfiandri et al., 2021), and usability testing with a high-fidelity Figma prototype (Abuaddous et al., 2022). Participants performed typical navigation tasks using a think-aloud protocol, providing insight into their cognitive processes. This approach ensures that both observable behaviors and subjective experiences are captured systematically (Bonet-Olivencia et al., 2024).

Instrument validity and reliability were ensured through expert judgment and peer debriefing, in which senior UX researchers reviewed the instruments for face validity and relevance (Abushark et al., 2021; Ilyas et al., 2022). Additionally, a pilot test with two target participants refined task instructions and difficulty levels to guarantee smooth data collection. These measures

strengthened the credibility of the findings and ensured that the collected data accurately reflect participants' navigation challenges (Meyer et al., 2021). Ethical procedures were followed rigorously, including informed consent, anonymization, and secure storage of audio recordings (Perrig et al., 2024).

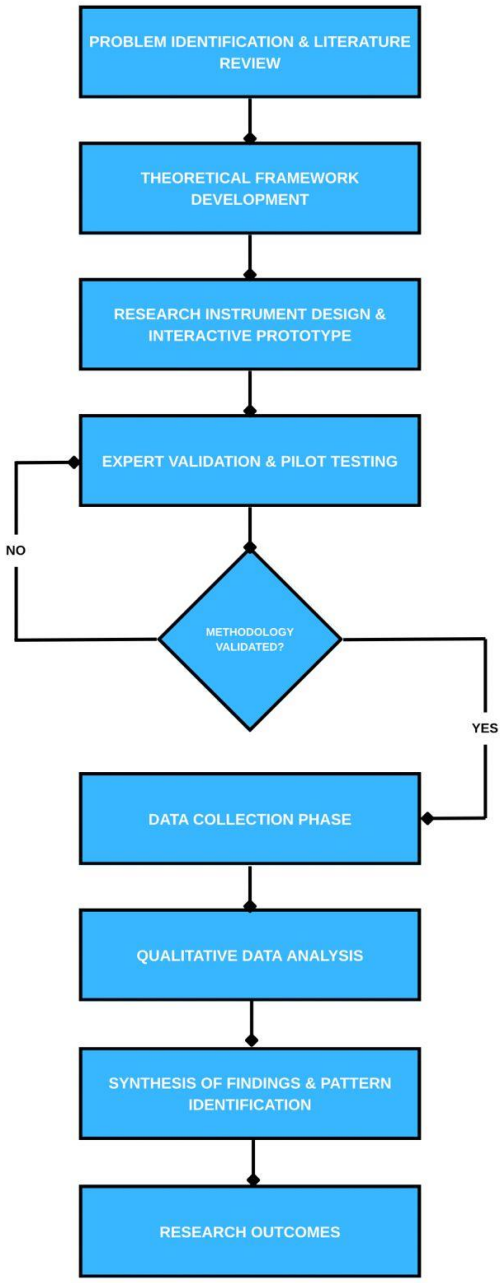

Figure 2. Research Procedure Workflow

The figure has been improved to enhance clarity, with larger fonts, clear labels, and a simple, logical flow (Abuaddous et al., 2022). This ensures readers easily understand the workflow without confusing.

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A. Coding Process

Qualitative data were transcribed verbatim and imported into a qualitative analysis environment. Coding followed a hybrid approach: deductive codes were applied based on Nielsen's heuristics (e.g., visibility of system status, match with real world) to provide theoretical alignment (Azizi et al., 2021; Ilyas et al., 2022), while inductive coding captured emergent themes from user feedback. Intercoder agreement and peer debriefing ensured reliability, as multiple researchers coded independently and resolved discrepancies through discussion (Meyer et al., 2021; Perrig et al., 2024). This approach guarantees that the coding accurately represents participants' perspectives and provides a solid foundation for identifying meaningful patterns.

B. Theme Identification

Coded segments were grouped into broader themes, such as "iconography confusion," "difficulty finding settings," and "bottom navigation preference." Themes were iteratively refined using the Miles and Huberman method to ensure they faithfully represented participants' experiences. This process links results directly to observed behaviors and verbalized user experiences. By connecting empirical observations to actionable design recommendations, the study ensures findings are both rigorous and practically relevant (Abuaddous et al., 2022; Zulfiandri et al., 2021).

IV. RESULT

Usability testing produced quantitative performance data based on task success rate, task completion time, and navigation error frequency. The average task success rate across participants was 73%, indicating that approximately one in four critical tasks could not be completed without external assistance. Task completion times ranged widely from 8 seconds to 67 seconds for the same primary navigation task. This wide temporal variation reflects substantial differences in operational efficiency among users. The distribution of task completion time is visualized in Figure 3. Based on the plotted data, 9 of 15 participants completed the assigned tasks in under 30 seconds. In contrast, 6 participants required more than 31 seconds, with several exceeding 50 seconds. This indicates a non-uniform performance pattern across the participant group. Navigation error analysis revealed an average of 2.8 errors per user during task execution. These errors were concentrated around interaction points involving icon selection and back-button navigation. Error logging showed repeated misclicks and delayed corrective actions at these locations. This error clustering suggests the presence of specific interface-level obstacles.

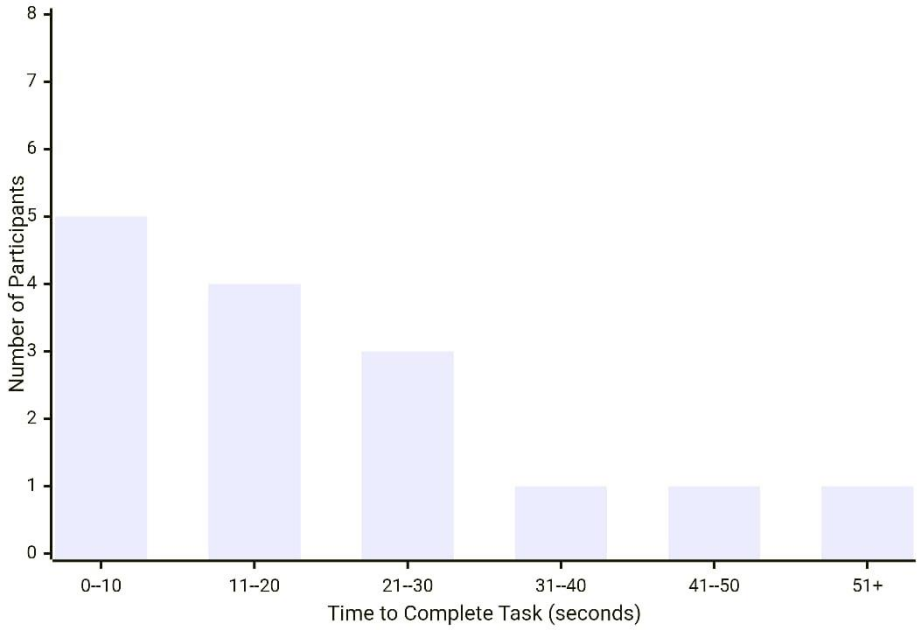

Figure 3. Distribution of Task Completion Times (N=15)

Figure 3 presents the empirical distribution of task completion times for all participants (N = 15). The data demonstrate a non-normal, highly right-skewed distribution. Most values are concentrated below the 30-second threshold, while a substantial tail extends toward longer durations. Extreme values exceeding 50 seconds are observed in multiple cases. The same participants who exhibited prolonged completion times also recorded higher frequencies of navigation errors. This pattern is observable through the alignment between time-stamped usability logs and interaction error markers. The temporal dispersion therefore appears across both speed and accuracy dimensions. These results establish a measurable performance imbalance within the test group.

Four dominant usability themes were identified and mapped to Nielsen's heuristic principles, as shown in Table 3. The most frequently reported issue was "Recognition Over Recall," cited by 14 of the 15 participants. The second most frequent theme was "Consistency and Standards," reported by 12 participants. "Visibility of System Status" was reported by 9 participants, followed by "Match with the Real World" reported by 7 participants.

Table 3. Summary of Key Usability Issues and Frequency

Usability Issue Theme	Related Nielsen Heuristic	Number of Participants Reporting (n=15)	Representative User Quote
Recognition Over Recall	Flexibility and efficiency of use	14	"I didn't know what the person icon meant. Is it my profile or other users? I just clicked it to see."
Consistency and Standards	Consistency and standards	12	"I expected the back button to be on the top left, like in other apps. Having it in the bottom bar was confusing."

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Visibility of System Status	Visibility of system status	9	"After I tapped, nothing happened for a second, so I tapped again. Then it jumped two pages ahead."
Match with Real World	Match between system and real world	7	"The menu said 'Workspace.' I wasn't sure if that was for projects, my files, or something else."

Table 3 quantifies the frequency of each heuristic violation and includes representative user quotations. Participants repeatedly indicated uncertainty when interpreting unlabeled icons. They also reported difficulty locating the back button due to inconsistent placement. All reported issues were empirically derived from direct observation and verbal protocol data.

V. DISCUSSION

The dominance of "Recognition Over Recall" violations indicates that users were repeatedly forced to rely on memory rather than perception during navigation. This condition arose primarily from ambiguous icon usage and the absence of supporting textual labels. When interface elements required recall-based guessing, users defaulted to trial-and-error interaction strategies. This behavior directly explains the elevated error rates and extended completion times observed in Figure 3. The frequent occurrence of "Consistency and Standards" violations further disrupts user mental models. The placement of the back button in a non-standard location conflicted with habitual navigation patterns. This inconsistency increased hesitation time and led to delayed corrective actions. These findings confirm that violation of platform conventions significantly weakens navigation fluency in a local usage context.

The impact of unclear iconography observed in this study is consistent with findings reported by (Miraz et al., 2022), who demonstrated that non-standard interface semantics increase users' cognitive workload. Similar usability breakdowns caused by ambiguous symbols were also reported in healthcare information systems by (Azizi et al., 2021) and in mobile banking apps by (Hamid et al., 2022). However, this study extends prior work by identifying the specific icon-label pairs that triggered confusion during real-time interaction.

Comparable usability degradation caused by semantic inconsistency in enterprise mobile systems has also been reported by (Othman et al., 2022). Unlike automated testing approaches discussed by (Abuaddous et al., 2022), the qualitative method used in this research enabled direct identification of semantic ambiguity at the label level. Moreover, while (Aldi & Wahyuddin, 2022) In the context of implementing User-Centered Design at a system-wide scale, this study demonstrates that significant usability gains can be achieved through localized component-level evaluation alone. This confirms the effectiveness of heuristic inspection as a low-resource yet high-impact evaluation method. This component-level usability refinement strategy is further

reinforced by the design intervention framework proposed by (Wiberg & Stolterman Bergqvist, 2023).

Based on the empirical findings, several actionable design revisions are required at the interface level. First, all symbolic icons related to user identity, workspace access, and system settings should be paired with explicit textual labels to eliminate guesswork based on recall. Second, the back-navigation control must be permanently fixed at the top-left corner in compliance with dominant Android and iOS navigation standards. Third, real-time visual feedback, such as loading indicators or animated state transitions, must be added after every tap to reinforce "Visibility of System Status." These design intervention patterns align with applied usability optimization strategies in adaptive mobile systems (Othman et al., 2022; Wiberg & Stolterman Bergqvist, 2023).

Menu labeling should be localized using terms that directly reflect the users' everyday operational vocabulary. Generic labels such as "Workspace" should be replaced with contextually anchored terms such as "Projects" or "My Files." In addition, hierarchical menu depth must be reduced to minimize the number of navigation steps required for primary tasks. These interventions directly target the three most frequent heuristic violations reported in Table 3. Recent adaptive UX personalization models confirm that semantic localization and layout simplification significantly improve task efficiency in dynamic interfaces (Divyadharshini et al., 2025).

The theoretical and practical contributions of this research are formally presented in Table 4. At the theoretical level, the study empirically confirms that heuristic violations exert measurable, context-dependent effects on task efficiency and navigation accuracy. This reinforces the necessity of culturally aware HCI validation frameworks rather than universalized design assumptions. It also demonstrates that localized usability validation remains essential even when global design heuristics are applied.

Table 4. Theoretical and Practical Implications of the Research

Type of Implication	Description
Theoretical	Extends UCD and Heuristic Evaluation theory by demonstrating their critical role in localized validation, not just global design. It provides empirical evidence that heuristic violations have a measurable and context-dependent impact on user performance, reinforcing the need for culturally-aware HCI frameworks.
Practical	Provides a replicable, low-resource methodology for developers and designers to conduct localized usability checks. Offers a specific set of problematic design patterns (e.g., ambiguous icons, non-standard back buttons) to avoid, along with actionable recommendations, such as always pairing icons with clear text labels and adhering to platform-specific navigation guidelines.

From a practical perspective, this research provides a replicable evaluation framework for developers operating under limited time and budget constraints. Designers are provided with a

prioritized set of navigation risks that can be corrected without full system redevelopment. The results directly translate into concrete interface-level revisions that can be immediately deployed in iterative design cycles. This supports rapid usability improvement in real-world mobile application development. This rapid-iteration-based usability-correction model is consistent with the incremental UCD framework proposed by Aldi & Wahyuddin (2022).

Although the qualitative depth of this study is sufficient for localized usability diagnosis, the limited sample size constrains the generalizability of the findings. Future studies should involve larger participant pools across multiple demographic segments. The investigation was also restricted to a single application type, which limits cross-domain inference of usability. Navigation behavior in gaming, e-commerce, and enterprise systems may exhibit different levels of heuristic sensitivity.

Future research should integrate large-scale quantitative validation such as A/B navigation testing to triangulate the present results. Adaptive interface research enabled by AI-driven personalization models also represents a promising extension of this work. Emerging studies on immersive navigation and adaptive learning systems indicate that context-aware interfaces will increasingly dominate future UX development. The present findings therefore serve as a foundational reference point for these advanced navigation paradigms.

VI. CONCLUSION AND RECOMMENDATION

This study demonstrates that context-based usability testing effectively uncovers critical navigation issues that universal design principles may overlook. Empirical findings indicate a 73% task completion rate and an average of 2.8 navigation errors per user, highlighting confusion caused by iconography, broken conventions, and insufficient system feedback. The research establishes a clear link between specific heuristic violations and measurable performance losses, providing a solid basis for diagnosing and understanding navigation usability problems. The major contribution lies in the pragmatic approach and contextual deployment, offering a replicable framework for conducting efficient, user-oriented tests under limited resources. From a theoretical perspective, it underscores the importance of localized HCI evaluation alongside global heuristics. Limitations include a small sample size and focus on a single application type, which may restrict generalizability across domains. Future research should expand to larger participant pools, diverse application categories, and the integration of AI-adaptive interfaces to dynamically tailor navigation to local user requirements.

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