Usability Meets Security: Enhancing Digital Security and Privacy Practices for Low-Literate Users in Bangladesh's Mobile Financial Ecosystem

by

Yousuf Abdullah Harun
20301139
Asiful Islam Chowdhury
17101140
Nurshida Akter Nilima
20301313
Hafsa Bintey Alim
20301488
Ashfiqun Ahmed Miftah
20301249

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Brac University
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Declaration

It is hereby declared that

1. The thesis submitted is our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. We have acknowledged all main sources of help.

Student's Full Name & Signature:

Yousuf Abdullah Harun

20301139

Asiful Islam Chowdhury

17101140

Nurshida Akter Nilima

20301313

Hafsa Bintey Alim

20301488

Ashfiqun Ahmed Miftah

20301249

Approval

The thesis titled "Usability Meets Security: Enhancing Digital Security and Privacy Practices for Low-Literate Users in Bangladesh's Mobile Financial Ecosystem" submitted by

1. Yousuf Abdullah Harun (20301139)
2. Asiful Islam Chowdhury (17101140)
3. Nurshida Akter Nilima (20301313)
4. Hafsa Bintey Alim (20301488)
5. Ashfiqun Ahmed Miftah (20301249)

Of Spring, 2025 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of B.Sc. in Computer Science on 20 June 2025.

Examining Committee:

Supervisor:
(Member)

Dr. Farida Chowdhury

Professor
Department of Computer Science and Engineering
Brac University

Program Coordinator:
(Member)

Dr. Md. Golam Rabiul Alam

Professor
Department of Computer Science and Engineering
Brac University

Head of Department:
(Chair)

Dr. Sadia Hamid Kazi

Associate Professor
Department of Computer Science and Engineering
Brac University

Ethics Statement

All necessary steps were taken to make sure the research methodology was ethically sound, including, but not limited to, the following considerations:

1. **Informed Consent:** The participants in the surveys and semi-structure interviews were all given full information about the aims of research and the planned use of their data. Participation was purely voluntary. Consent was obtained before data collection was initiated.

2. **Anonymity and Data Confidentiality:** The whole data collection process, including both sensitive and personal data, was done anonymously to maintain participant confidentiality, with enhanced security measures put in place for storing the data. Extensive precautions were taken to ensure participant anonymity, based on which no identifying information was disclosed at any point during the research.

3. **Compliance with Relevant Legal Frameworks and Regulatory Norms:** The research was conducted in total conformity with legal requirements and institutional guidelines. There were no violations of national and international laws and regulations related to data protection during the data collection and analytical stages.

4. **Research Integrity:** The authors guarantee that all the information presented is valid and accurate. All findings and results are original, and no fabrication, falsification, or plagiarism has been involved in carrying out or documenting this research. Proper citations were used wherever external information had been used.

By following these protocols, this research maintains the highest level of ethical integrity.

Abstract

This thesis explores and investigates the digitals security awareness and practices of rural populations in Bangladesh: focusing on Mobile Financial Service(MFS). Now that Digital MFS is becoming a foundation tool for more inclusive financial services, especially in rural areas, keeping these digital platform is a critical way to ensure secure transactions in Mobile Money. However, rural areas are less literate and they have challenges in comprehending and using security policies when using MFS. Yet this is a population that often lacks the requisite digital literacy to navigate through complex security features, and fall victim to fraud, phishing, and even more alarming, allowing a cyber criminal access to compromise their financial health.

A mixed methods design has been followed to conduct semi-structured interviews with community members and surveys for an in-depth study of the experiences and challenges in using MFS among the community members across rural Bangladesh. Lastly, this research explores how individuals interact with MFS platforms to uncover some pain points-e.g., misapplication of security instructions, transaction dependency on intermediaries, and cultural elements affecting trust in digital financial architectures.

The results are presented with a wide gap in the design of MFS security features and what is really needed by low-literate users. The thesis uncovers not only the threats to this demographic but also proposes concrete solutions to those threats in the form of simplified user interfaces, the use of visual cues, and security awareness programs tailor-made for a rural and low-literacy population. Finally, the paper highlights the importance of involving MFS providers, policy makers, and local communities together with the view to create solid security frames for this population in their specific context.

Added to this ongoing effort in paving ways toward a more digitally secure and hence financially inclusive setting, where in rural Bangladesh, digital security will facilitate the wide acceptance of the MFS system; lessons learned from this study have implications not only for improving more inclusive digital financial systems, which can meet the needs of vulnerable customers but also for contributing to trust and confidence in the conduct of digital transactions more broadly.

Keywords: Digital Literacy; Low Literacy; Privacy; Security Threats; Smartphone Use; Digital Safeguard.

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Chapter 1

Introduction

1.1 Motivation

As the population shifts more and more towards the online platform, the protection of such interactions is of high priority. The advancement of technology has been widely embraced within the social essence of human society in the present day generation to avail social, communication, information, and economic gains. However, with the move into the digital age, rural areas have spin both opportunities and threats. Mobile Financial Services (MFS) have undergone explosive growth in the last few years as more and more people in rural regions of Bangladesh are using mobile devices to access banking and payment services[22]. In spite of the benefits, these communities have special challenges in coding, managing, and securing those interactions with MFS platforms, given that typically these communities are characterized by their low literacy levels.

However, the rural population, which is characterized by low digital literacy, is still extremely vulnerable to numerous digital threats, including fraud, identity theft, and other types of financial scams[26]. While there has been a concerted effort to improve the level of digital literacy and reduce the digital divide, a lot of people in these areas still don't understand or make it difficult for them to adopt the security measures required for protecting their Mobile Financial Transactions. But because of how quickly people in rural areas are adopting smartphones and MFS, the efforts in terms of getting them educated on how to use it safely haven't kept up to fill that gap[26].

As risks like phishing, malware, financial fraud, and many more become crucial to digital safety for users, there has become a need for protection from risks. In rural Bangladesh, where access to a good education is limited and a large percentage of the users are unfamiliar with basic IT and MFS security tools, this is an important problem. These users are often the victims of digital abuse, not due to a lack of basic knowledge of MFS security features but because they use intermediaries or informal channels in case of help, making them even more vulnerable to these risks[10].

These global initiatives to close the digital technology gap often neglect security for low-literate MFS users. In addition to connecting rural populations to technology, the main challenge is keeping their financial transactions safe. But given that

many rural users are relatively illiterate, conventional methods of teaching digital security, which are fundamentally text-based, are ill suited for the rural user. It is, therefore, necessary to develop strategies that are simplistic in security for MFS users, a technique that will increase their awareness for the protection of their financial well being through the use of visual and localized approaches.

1.2 Problem Statement

This paper investigates digital security awareness and experiences about use of Mobile Financial Services (MFS) among low-literate rural Bangladesh users. As MFS has become a necessary tool for promoting financial inclusion, especially in underserved areas, security of these platforms is becoming essential to the whole innovation. But users in rural, non-literate areas are facing great barriers in understanding and implementing needed security measures, and therefore not being able to use these services safely and efficiently. Since they are unaware of such a lack of security, they become extremely vulnerable to all sorts of digital threats, such as phishing scammers, identity theft, fraud, and unauthorized access to the account in the MFS ecosystem[28][21].

This makes the problem even more complicated by cultural and contextual factors. In Bangladesh, the adoption of secure practices is also made tough by rural socio-economic conditions, cultural norms, and a lack of formal digital literacy education. For instance, these types of users depend mostly on informal channels, such as word of mouth, local intermediaries, and peer networks, to learn about MFS, but are not always sure, or made aware, of how to use the MFS in a secure manner. Thus, rural MFS users fail to or misunderstand basic security practices, exposing them to exploitation[28].

The problem of MFS platforms is most actively linked to the design of these platforms.There are many interfaces designed for non low literate users (the most important of which are dominated by text heavy instructions accompanied by fancy security, in the form of PINs, passwords, and transaction verifications). It is a barrier for these rural, low literate users, who may not be able to read and understand these features, and hence a very difficult barrier for them to secure operations. But none of the MFS platforms we tested offered other methods, like visual cues or voice prompts, that would make it easier for users with poor literacy to use these security protocols. This makes users much more unable to safely guard their financial information and be tricked into scams or to make serious mistakes in security[28][21].

Furthermore, there are more levels of complexity in the problem introduced by socio economic and cultural factors. Community is at the center of rural life, yet in many rural communities, device sharing among relatives and neighbours is common, exposing privacy and security. Many users are not clear about the concept of individual digital ownership — some give away their PIN, password or account info freely, thinking that is the right thing to do. Moreover, personally identifiable financial data can be misused through informal networks or local intermediaries assisting

in financial transactions, expanding the risk of fraud further. This ongoing threat to the integrity of MFS usage in rural areas is attributable to inadequate awareness of the importance of securing personal financial information.

Additionally, the lack of structured training of the users on the digital competencies makes the situation even worse. There are a lot of users who don't even understand the basics, like how to create a strong password or how to detect fraud messages or confirm transaction authenticity. In such environments where education is limited and formal training is minimal on digital security, low literate users are increasingly exposed to very sophisticated fraud techniques.The vulnerabilities of conventional information, be that as it may, compound with the development in users dependence on MFS for day by day from getting settlements to paying bills and more so the potential for advanced victimization gets to be more conceivable.[28]

MFS platforms typically assume a level of literacy and technical fluency from users, which is both very difficult and often impossible for individuals with less education. Low literate users often discover that interfaces and security features such as two factor authentication are inaccessible, and respond by simultaneously skipping around these security features or create an opportunity for their account to be put at risk. This points to a much larger gap within technology design and rural, low literate populations' needs. However, these users are often excluded from safe guarding their digital financial transactions, thereby diminishing the actual promise of MFS as an economic empowerment tool.[28][21]

In summary, the problem that comes into focus is MFS (Mobile Financial Services) usage and digital security among rural populations of low literates in rural Bangladesh. Yet we have a critical gap in our understanding of how these users interact with MFS platforms, how literacy and socio-cultural factors shape their security behaviour, and the challenges they face in protecting their financial transactions.This is a critical problem to be solved in order for MFS to be a truly secure and inclusive financial tool — for the millions of people, especially those living in rural, low literate communities, that are at greatest risk of exploitation in the digital world.

1.3 Research Objectives

This research seeks to analyze the digital security understanding and approaches by low-literate users for digital safety in rural Bangladesh with reference to Mobile Financial Services (MFS). This study aims to:

1. **Objective 1:** To understand the challenges that low literate users in rural Bangladesh face in using Mobile Financial Services (MFS) platforms. Such difficulties include being unable to understand digital security features, dealing with interfaces and secure transaction management.

2. **Objective 2:** Evaluate the effectiveness of these challenges in terms of their capacity to impair the understanding and utilization of digital security measures.

3. **Objective 3:** The task for the conceptualization of the topic is to define certain cultural and contextual factors that influence people's attitudes and behaviors towards digital security issues in such populations.

4. **Objective 4:** Make some practical recommendations on how the user interfaces should best be designed if consciousness and control among the less literate in digital security are to be stepped up.

Chapter 2

Literature Review

2.1 Introduction

Due to the growing dependence on technology and the Internet in our communication and everyday life, there has been a rising need for digital security awareness and secure behavior. This need is even more significant when considering rural residents of a country like Bangladesh, where average literacy levels are low, making it challenging for individuals to understand and apply safe practices in using digital devices and platforms. This review provides an overview of the literature on digital literacy, awareness of digital security, and the challenges faced by low-literate people, especially in rural areas.

2.2 Digital Security Awareness and Practices

In [19] and [23], the subject of discussion is the level of awareness of cyber security among young people of the country, which is quite similar to the objective chosen by our thesis: the level of awareness of digital security among rural populations. Both works indicate that understanding user activities in security-related contexts is crucial.
Because it focuses on particular users of these sites, Alotaibi et al.[23] research on digital security on social networking sites differs from ours in that it raises a similar concern, namely recapitulation of digital security awareness [23]. When comparing the two studies, despite the differences in demography, there is limited knowledge and awareness of the threats in the digital environment and therefore the necessity of prevention interventions.
Naga et al.[29] focuses on the vital meeting point between information security practices and personality traits in a time when dependence on technology is growing [29]. They investigated the relationship between information security awareness and the Knowledge-Attitude-Behavior (KAB) components of the Big Five Personality Traits (BFI) using a quantitative approach. A key similarity between our work and the study on personality traits and information security behaviors is the emphasis on understanding individual factors in shaping cybersecurity attitudes and behaviors. Both studies recognize the importance of considering personal characteristics in developing effective security measures. Their study examined correlations between information security risk status and BFI personality traits using logistic regression

modeling and Spearman correlation analysis, with 311 undergraduate students chosen through stratified random sampling as study participants. In order to determine security awareness and practices among our nation's less literate citizens, we also conducted a pilot study. A possible shortcoming in the Naga's[29] work, though, is the lack of a qualitative analysis to supplement the numerical results. Adding qualitative data could improve the subject's overall comprehension by providing deeper insights into the attitudes and motives influencing information security behaviors.

2.3 Digital Literacy and its Implications

Eshet-Alkalai[2] focuses on the meaning of digital literacy for the safe use of development, emphasizing the need for people to have a range of capacities beyond basic codes of action in order to effectively examine advanced scenarios[2]. This is consistent with the proposition's emphasis on the outcomes of cutting-edge ability in typical areas, particularly in areas with limited access to innovation and formal education. Both Eshet-Alkalai's[2] findings and the evaluation of problems in common in Bangladesh highlight the need for efforts to further cultivate attitudes toward technology and internet usage in rural areas[2].

When looking at advanced security concerns and updated features among illiterate people, it is critical to evaluate the prospective benefits and downsides of each perspective. Automated security care highlights understanding the risks related to using development and taking precautions to protect personal information and devices. Exposing problems concerning cutting-edge security can help low-capability groups avoid digital threats and protect sensitive information. Regardless, a possible challenge is properly conveying difficult safety concepts to people with limited abilities and capacities, which could limit their capacity to carry out safeguarding activities.

Of course, high-level education for low-capability people focuses on developing the abilities required to investigate upgraded devices and phases. This section discusses activities such as assessing guidelines for visual locations of collaboration, evaluating information authenticity, and creating critical content using digital resources. Individuals may gain access to a variety of knowledge and open virtual doors by working on revolutionized abilities, inviting them to participate more fully in an automated society. Regardless, a disadvantage could result from the need for targeted learning tasks and resources to assist low-capable individuals in obtaining these skills, which might require huge hypotheses and systems.

Taking everything into account, both high-level security awareness and digitized guidance play critical roles in assisting low-capability people to engage safely and successfully in the digital space. While modern security care reduces risks and safeguards personal data, automated capability allows individuals to get the most out of the benefits of development in learning and interaction. By keeping an eye out for the incredible challenges and tremendous opportunities given by each viewpoint, efforts can be made to fill the fundamental gap and increase wide access to digital resources for every individual, irrespective of their educational level.

2.4 Difficulties in Rural Contexts

Low-literacy users from rural Bangladesh have specific concerns that need to be addressed to strengthen educational practices focused on digital security. The issues highlighted in the Pilot Study and Shaikh et al.[25] are also useful in generating insights, which are part of the focus of our thesis regarding the presence of digital security awareness among rural populations [25].

A study on the general effects of low literacy levels reveals that people in rural areas are limited in their interaction with technological devices and have limited knowledge regarding digital security. Overall, due to the low levels of literacy common amongst these users, most of the rural users are unable to read and comprehend what they read and, therefore, have no ability to notice interfaces, security threats, and other important aspects of digital security. This barrier makes it crucial to provide the educational approaches that would suit the needs of low-literate people. For example, Medhi et al.[4] also underscore the need to incorporate usable designs that would make it possible to cater for low literacy users through the use of vision graphic controls and icons [4].

The studies reveal that rural users are rather uninformed and unprepared for digital security issues. Lack of preparedness means that even those who may access these educational resources may not be in a position to use them properly. In the case of rural users, the Pilot Study shows that these consumers are not only unaware of the potential risks involved in performing digital activities, but this state of ignorance also increases the likelihood of falling prey to security threats. Shaikh et al.[25] affirm this argument by pointing out that communities in rural Bangladesh have the elementary exposure that they need to seek health services and access knowledge but cannot make sense of why digital security is essential [25]. Other similar studies, like the one conducted by Hasan et al.[25], also affirm this assertion by illustrating the negligible knowledge of cybersecurity among rural internet users [18].

The Pilot Study and Shaikh et al.[25] pay special attention to educational interventions and the lack of people's knowledge of digital security threats. Of course, these interventions should be created with the appropriateness of a rural, low-literate audience in mind. Upcoming interventions will cover skills such as employing visual symbols, teaching point-to-point with audio, and showing with practical tutorials. The goal is to develop practical and realistic instructional information that includes references to what low-literacy users may do to improve their digital security. About this, Kumar et al.[13] have highlighted that the most recommended strategies for technology education are those that will be implemented in the community using strategies that are suitable for the community in question, especially where this is a matter of the rural region [13].

Another factor that establishes the level of awareness of digital security among rural people is related to culture and socio-economic status. This is particularly a problem in rural areas where the uptake of digital devices and the internet, which could help in the teaching and practice of digital security, is low. Moreover, technological and educational beliefs and perceptions across cultural boundaries can affect people's desire to engage in programs on digital security training. It is important to comprehend such factors to implement strategies that respect the cultural background of the participants and are cost-effective. Heeks[5] suggested that governments need to take into consideration the culture and economy of rural people while introducing

digital education programs [5].
Future studies should therefore concentrate on designing and evaluating specific educational interventions for low-literacy learners from rural areas. Future research should aim to understand how best to present and convey information on digital security, whether through mobile technology, traditional classes and workshops within the community, or mentorship as carried out among students. Also, we must assess the impact of such interventions on enhancing security literacy among rural users and customers. Other research, such as that of Parikh et al.[1], has demonstrated that training campaigns carried out by communities can greatly improve digital literacy and security awareness.
Based on the above findings, it can be concluded that to overcome the digital security issues of low-literacy users in rural Bangladesh, a comprehensive series of investigations and advancements must be performed to overcome illiteracy, increase awareness, introduce literate-based educational initiatives, and analyse culture and economy. To this end, it is possible to focus on the mentioned areas as the main priority to work on in order to boost digital security literacy among rural people.

2.5 MFS (Mobile Financial Services) and Digital Security

MFS, like bKash, Nagad, Rocket, and Upay, is an area where privacy and security breaches are highly probable. Mobile financial services have seen wide adoption in developing regions, including Bangladesh. However, the rise of MFS usage among low-literacy users, particularly in rural areas, increases the risk of security breaches due to their limited understanding of digital security measures.
In a study conducted in India[6], a simplified UI design for MFS applications was proposed. This included features like tabular data organization, numeric data formats, representational icons with icon legends, and discrete task spaces with vibrant colors. After implementing these features in prototypes, significant improvements were observed in user interaction and security awareness.

For low-literacy users, complex UI design often hinders their ability to engage securely with MFS platforms[27]. Many users are unable to comprehend text-heavy interfaces, making them more susceptible to privacy and security threats. To address this, it is essential to create graphical, intuitive interfaces that guide non-literate users in securing their financial transactions.

Similar to our thesis's focus on creating useful user interfaces for low-literate people, the investigation of Digital Privacy Challenges and Text-Free UI for Illiterate Users presents viable answers for improving digital accessibility [16]. Even while these studies might not fully address issues unique to Bangladesh's rural areas, they still offer insightful information on inclusive technology design and how it affects people's knowledge of and behaviors around digital security.
Different approaches have been done in previous studies,Give users the ability to see interactions with larger-sized widgets through their design [8]. The study of their research shows Not only were large sizes of all widgets more effective than tiny sizes,

but the majority of participants also preferred large sizes [8]. They also proposed a radio button system by pressing that button user can get a voice feedback of navigation throughout the application. With the combination of big sized widgets and Radio button the result of their survey was pretty positive. In the survey participants were asked to identify click some icons of different sized,The interaction times of the various widgets were found to differ significantly (p=0.001). The icon grid (p=0.013) and radio button grid (p=0.001) outperformed the check box grid in terms of speed. Small sizes took noticeably longer than large sizes, with a significant difference between them (p=0.002) [8].
Another Research was done on Text free UI which proposed recommendation like avoiding text in the UI, using semi-abstract graphics and increasing photo realism with deeper interactions,providing voice feedback for all functions of the application,Provide a help button on every screen of the application. Their result of the research has shown It makes reasonable to use less text with non-reading subjects. But since subjects were able to recognise numerals like "0," "1," "2," "3," "4", and so on with ease, these numerals can stay in the user interface (at least for some target users) [3].
Microfinance, or mobile banking, is an area where privacy and security breaches are most likely to occur. Developing regions have already adapted to mobile banking. In Bangladesh, the proportion of businessmen with low levels of literacy is increasing, and most of their enterprises require mobile banking, which can pose serious security and privacy risks.A research has done in India which was based on simplified UI design for micro finance application. They have proposed a Tabular Data organization within the app, Numeric data format, Representational Icon with Icon Legend, Discrete Task space and use of vibrant colors [1]. After these implementations in their prototype significant improvements were seen.
These are some common and significant recommendations that was suggested in previous research works. Complicated UI design has a significant impact on the digital device usage of people with low literacy level. The two biggest obstacles that designers encounter when creating user-friendly user interfaces for illiterate users are their lack of knowledge and their incapacity to comprehend text. Typically, they create interfaces that are too text heavy and inappropriate for non-literate users. This suggests that in order to create a system that meets our objective of maximising the contributions of the illiterate, our user interface needs to be a little more graphical and capable of guiding the non-literate population, which presents a difficult task for designers[24].

2.6 Policy Implications

Two studies, The Digital Bangladesh Initiatives and The Influence of Adopting a Text-Free User Interface on the Usability of a Web-based Government System with Illiterate and Semi-Literate People and Digital inclusion for low-skilled and low-literate people: In the previous chapters, based on a contextual review, some policy recommendations for enhancing the low-literate people's privacy and digital security in Bangladesh have been delivered [16]. The implications of the national level policies and interventions concerning this issue of digital divide and inclusion has been explained in the light of the pilot study, as the low literates of our rural areas are illiterate about the implications of digital security and do not know the worth

of protecting their online privacy [15]. Our study's findings are consistent with our thesis, which is that appropriate interventions and policy formulations are necessary to reduce the digital divide, especially in Bangladesh's rural areas.
Because of this, our research framework is predicated on an understanding of the various dimensions of the digital divide that extend beyond its most widely used definitions. By adopting a user-centered approach to target underrepresented low-literate populations, in particular, the users involved in this study represent a group of low-literate people living in rural Bangladesh Due to these reasons and the current global challenges in online safety, the study presented here aims at developing practical strategies for designing user-friendly interfaces to enhance low-literate users' digital security in Bangladesh adequately. Specifically, the following are some of the strategies that have been put in place :–
Text-Free Interface Adoption: For many of the development initiatives in e- government systems targeting the illiterate and marginated; the government and organizations have to think of interfaces without text. As it has been shown above, there is a reaction that this strategy enhances the satisfaction of the user and usability.
Fundamental Design Principles: The roles of the consciousness to keep the most apparent interface solutions may be underlined in policy recommendations. To ensure the engagement of users it requires avoiding the use of complex task actions, small graphics, and symbols to go for click or touch activities.
Usability testing and heuristic analysis: It is possible to establish policies that require the use of usability testing and heuristic evaluation when creating and evaluating web-based systems for users, especially those that address aspects of illiteracy or semi-illiteracy. There is a list of specific areas where findings of this study could be useful: the design and development of user-friendly interfaces that should enhance the accessibility and usability in terms of people with disabilities. These two approaches are rather complementary and can provide the exhaustiveness of the assessment of usability problems.
Combined Structure for Designing Images and Icons: It could be suggested that governments and organizations should use a specific set of recommendations on picture and icon design that reflects user needs, cultural factor, and usability standards. Possibly, this framework could help to economise the creation of acceptable and intelligible icons and graphics. Governments must support the training programs and capacity development initiatives for the designers, developers, and other actors in the e-government designs. Such programs should educate concerning the importance of user centered design and also guide the users on how to implement interfaces that do not rely on texts.
Accessibility Standards: To fulfill the previously described goals in providing e-government services, the government should implement the following accessibility standards: the WCAG, or Web Content Accessibility Guidelines. Thus, it will be seen that the concept of usability enables the e-government systems to remain predominantly usable by all citizens irrespective of the fundamental skills or lack of these in handling such systems. These rules can possibly continue Low profile design, no texts, the enhancement of the usability testing phenomenon.
Learning and Developing Capabilities: These sessions are beneficial for open-ended presence and could possibly assist cultivators in developing skills, asking questions and/or speaking to others for advice. Some of the measures that can be adopted by the policymakers to ensure that the concept of inclusive e-government interface

design are as follows:Integrating the government agencies, the business people and the universities in effort of drawing up of a common understanding of the best practices concerning the design of interfaces to the e-government. This can consist of co-coining of the Usability and Accessibility discussion forums, seminars and symposiums and co-operative work shops beneath which lesson learnt are exchanged.
Surveillance and Assessment: Therefore, in the interest of improving the usage of those text-free interfaces that are especially understandable by the illiterate and semi-literate values receivers, it is recommended that only those governments that are interested in the process of monitoring and evaluation of the performance of the invented interfaces do so. Concurrent assessment to promote efficiency of the e-government services helps in the identification of the adjacent areas that require addition and enhancement.
Our thesis strives to solve these complications, even if the described problems are not very complex to be understood by an average person, with the help of effective actions and policies that should reflect the native experience of Bangladesh rural folks. In regards to policy making and development of such approaches, only through such methods can one help 'advance' ways through which 'new' digital media can be better secured and made more accessible for ordinary citizens, who might not even be literate enough. Usability is underpinned by usability study and policy while knowledge about them is derived from policy development. For instance, they could propose to ensure spoken instructions, buttons or icons on digitally accessible devices that these people can use or developing interactive multimedia courses that may.
The comprehensive literature analysis delineates and elucidates the complex interplay of digital literacy, security consciousness, and socio-cultural elements that impact individuals' safe computer usage, particularly in rural regions. In order to address these issues and create a more equitable and secure online environment for all users, this thesis will draw on research on inclusive user interface design as well as earlier efforts to encourage better security practices among low-literate users in developing nations like Bangladesh. The objective of our research is to surpass conventional approaches that solely take into account the binary nature of the digital gap. Instead, we will attempt to comprehend the divide as a complex phenomenon that cannot be reduced to digital inclusion or exclusion. In the process of creating and executing our intervention, we want to uphold the rights of marginalized communities, such as the low-literate local viewers residing in rural Bangladesh. Our ultimate goal is to create a more secure and welcoming online environment where everyone may participate actively in society and the wider globe.

2.7 Conclusion

The literature review highlights the complex interactions between digital literacy, security awareness, and socio-cultural factors impacting the ability of individuals, especially those in rural areas, to use digital technology securely. Our research seeks to build on this knowledge, applying insights from previous studies to develop practical solutions for enhancing digital security among low-literate populations in Bangladesh. By focusing on creating accessible user interfaces and educational interventions, we aim to create a safer, more inclusive online environment for all users.

Chapter 3

Methodology

3.1 Semi-Structured Interviews

In order to develop an in-depth understanding of the usability, security, and privacy issues of low-literate users of Mobile Financial Services (MFS), semi-structured interviews were conducted. A qualitative approach offered the scope of an open and flexible investigation of user experience that could record both the problems and expectations of low-literate users in interacting with digital financial applications. The semi-structured interview method was adopted as it could produce rich contextual information while possessing a focused and structured scope on research areas.

3.1.1 Participant Demographics

The 50 semi-structured interview participants were chosen to give a range of low-literate users in rural Bangladesh. Participants were chosen based on certain demographic attributes to ensure the sample was representative and generalizable to the research issue. The participant information was:

- Age: Participants' age varied between 18 and 60 years. This assisted the research in obtaining experience from both young and elderly users as low-literate individuals spanned across different ages. Although the younger participants would be more likely to be technologically savvy in the application of common mobile phones, the older users would be less exposed to digital financial services.

- Gender: The gender split was equal, half male and half female, and thus both male and female low-literate users' views were represented in the study.

- MFS Usage: All participants were familiar with the general mobile phone functions but lacked or had minimal experience with using digital financial services. Most of the participants were using USSD services to carry out their financial transactions due to low literacy rates, making them the ideal candidates for the study.

- Geographic Location: The respondents were from rural areas, where MFS apps are promoted but there is low uptake due to the digital divide and illiteracy.

This group of participants assisted in ensuring that the findings obtained were well grounded in the actual challenges that low-literate users encounter when utilizing MFS apps in rural areas.

3.1.2 Interview Design

The interview structure was framed to question three overall themes: usability, security, and user expectations. Through the use of the semi-structured approach, the interviews left space to discuss at length the participants' experiences and still question broad subjects in each interview.

Question Structure:

The questions were designed to gather descriptive and interpretive information. Even though the interviewer had a list of questions that she followed, the semi-structured nature of the interviews allowed leeway for participants to describe experiences and attitudes without constraint. This allowed room for the interviewer to ask follow-up questions, pursue issues at a deeper level, and adjust the conversation pertaining to the experience of the specific participant. The questions were open-ended in nature and designed to invite holistic answers and allow a flow of conversation. Some of the key questions asked in the interviews were: "Could you share with me your experience of using a mobile banking app? What did you like about it, and what annoyed you?"

"How do you normally carry out finance activities, such as paying bills or sending money? Do you do so alone or with help from other individuals?"

"Did you ever have issues with the security aspects of the app, such as PIN input or fraud notifications? What was the experience like?"

"Which things would make it simpler for you to use a mobile financial app independently, without needing to ask for help?"

The interviews were conducted using local dialects, thus ensuring participant ease and encouragement of thorough self-expression. The interviews lasted between 30 minutes and 1 hour, thus ensuring enough time for participants to express their experiences, answer questions, and provide elaborate feedback. The interviews were conducted in personal settings, which was critical since this provided an opportunity for participants to speak freely without any external influence. To ensure reliability, all the interviews were taped with audio equipment (with participants' consent) and later transcribed verbatim. The transcription process allowed for a systematic analysis of the answers and thus enabled the detection of emergent themes and patterns across different participants.

3.2 Findings from the Semi-Structured Interviews

The semi-structured interviews provided a wealth of information on usability and security problems of low-literate users in using Mobile Financial Services (MFS)

applications. There were several key issues, expectations, and behavior identified and used to inform the design and development of the simplified MFS app. These have been categorized under three theme groups: Usability Challenges, Security Concerns, and User Expectations.

3.2.1 Usability Problems

The most insightful finding from the interviews was the complexity of MFS applications present today and how challenging it proved for low-literate users to use the app and make financial transactions independently.

Complex Navigation

- **Menu challenge**: Most of the respondents said that they had difficulty understanding menus that were not user-friendly. They described processes of performing routine tasks, such as checking balances or transferring funds, as being complex and very time-consuming.
- **Small font sizes and unclear icons**: Small font sizes and unclear icons in the existing applications were some of the reasons for user dissatisfaction. The majority of the participants were unable to read the text or recognize the icons accurately, which discouraged successful transactions or gaining access to the needed functionality.
- **Too many steps for tasks**: Tasks that are supposed to be simple were divided into too many steps, which were confusing. For example, to transfer money, there were multiple confirmation pages and a block of hard-to-read text on each page. Users would drop such tasks or seek help from someone else.

Text-Heavy Instructions

- **Ease of instructions**: Respondents found it difficult to read-heavy instructions. Instructions that dealt with how to conduct transactions in most cases were either too complicated or difficult to understand, particularly for respondents with low levels of literacy.
- **Visual preference**: The participants overwhelmingly preferred the use of visual aids (i.e., pictures, icons, and symbols) over text content. Simple, icon-based navigation was proposed by most of the participants as it would make it easier to use the app.

Inconsistent Terminology

A few of the participants were confused due to inconsistent terminologies used in various sections of the application. Terminologies like "transfer," "balance," and "recharge" were not easy to understand and meant something different depending on the context. Participants suggested that clear and consistent terminologies that are easy to understand be applied to all of the application's features.

3.2.2 Security Issues

Security was a major concern for low-literate users. The majority of the participants never felt safe using MFS apps due to the complexity of the security features and fear of committing errors. This was worsened by the lack of proper knowledge of the app's security features and privacy policies.

PIN Sharing

- **PIN sharing for assistance**: Most of the users had given their PINs to relatives or people they trusted so that they would be able to make transactions. This was due to a lack of confidence in using security features on their own. The users also showed a lack of knowledge about PIN management and acted on the belief that sharing was the only way to avoid possible mistakes.

- **Fraud risk**: Sharing PINs is a serious security threat as it leaves users at risk of fraud or unauthorized transactions. Users knew that they are likely to be defrauded but powerless to protect their PIN because of complex security control procedures appear in app.

Ambiguous Security Features

- **Lack of understanding of the PIN authentication:** The process was noted in most participants, as they exhibited limited knowledge of its functionality in protecting their transactions. In addition, many individuals held the false perception that mistakes in entering the PIN may lead to financial loss, a perception that eventually led to their disuse of the application.

- **Misunderstanding of fraud alerts:** The app's fraud alerts had thrown the users for a loop. They ignored or misread warnings that led to a lack of faith in the app's ability to protect them from fraud. User-friendly fraud protection alerts instead of lengthy complicated ones were recommended.

- **Poor security definition:** Users were feeling insecure with the app, as security settings that included 2FA or SMS alerts were not made clear. The respondents lacked trust in the security of the app in general and wished there would be more clearer and easy-to-understand security behaviour.

3.3 Development of the Simplified MFS App

Based on the insights and learnings from the semi-structured interviews, we approached the next step in this research, which was creating and implementing the simplified MFS app. This was in order to design an app to address the main usability and security issues that low-literate users grapple with in a way that would enable them to undertake simple financial transactions securely and independently. This is the section where we describe the development of the simplified app, the features, the design principles used and how all the changes were made with the intent to satisfy the the target users.

3.3.1 Design Approach

The app was designed iteratively, based on a user-centred design approach, the semi-structured interviews thus directly informed the design. Key points of development were:

- Simplification of User Interface (UI): The app had to be intuitive, user-friendly and visually appealing to low-literate individuals.
- Enhancing Security: The functionality was added in order to address security issues which arised concerning handling of PIN and also various transaction problems.
- Improving Usability: Priority was given to features that lowered cognitive burden and made tasks accomplishable.

The development was done with a UX/UI designer, security experts, user experience researchers to have the design of suitable app, and based on the findings from the interviews the app that works well, is safe to use and decent looking.

3.3.2 Principal Features of the Simplified MFS App

Some key features were added to the streamlined MFS app to make it more secure and easy to use for low-literate customers. The features were added specifically to address the issues and desires articulated in the interviews.

Larger Fonts and More Readable Icons

Among the primary usability problems that arose during the interviews was the extremely tiny fonts and confusing icons of existing MFS apps. The low-literate users reported that they could not read the text and understand the icons, thus finding the app difficult to use and accomplish tasks.
Purpose for which:

- Larger and more legible fonts were used to ensure utmost readability of the text, especially for older users or with poor reading skills.
- Icons for fundamental operations such as send money, check balance, and payment were made more intuitive and simple. Icons were selected to be visually distinct from one another as well as easily identifiable even without textual labels.

Double Confirmation for Transactions

Among the security concerns raised in the interviews was the possibility of mistakes during transactions, namely sending money to the incorrect individual. Interviewees indicated that they did not always rely on the transaction process and were concerned about mistakes. For improved security and fewer errors:

- A two-stage verification process was employed in the application for sensitive operations such as the transfer of funds.

- This system asks users to confirm the transaction details (e.g., recipient's name, amount) before proceeding, providing the user the opportunity to review the details before finalizing the transaction.

Help Guides

Audio, Video, and Text Perhaps the most common user requirement was requiring help guides that would explain to them how to use the app. The majority of the low-literate users wanted audio and video guides because they were more comfortable listening or watching than reading. To meet this requirement:

- Audio cues were added to guide users through significant steps and actions inside the app. The cues provided brief, crisp instructions on what should be done next (for instance, "Click here to send money" or "Enter the phone number of the recipient").
- Video tutorials were also provided to demonstrate common actions, such as transferring money, checking balance, and recharging mobile credit. The tutorials were made intuitive and visually simple, with voiceover instructions to accompany each step.
- Instructions were also provided in text format to individuals who could read to enable the use of the app by more individuals.

Automatic Guided Mode

To offer more support to users who have minimal or no experience using MFS apps, an automated guided mode has been established. It will guide users through task completion automatically, reducing users' need to search for assistance or seek help. The automatic guided mode guides the users through all the steps of significant processes (e.g., sending money, paying bills) and gives feedback to the user through sound about what the user should do. This feature is enabled by default when the users start a transaction such that the app is always ready to help users whenever they need it.

3.3.3 Usability Testing and Iterative Design

When the initial version of the MFS app was designed to be made simpler, it also went through an iterative testing process to ensure that it would be accessible to low-literate users. The process of usability testing comprised the following steps:

1. **Initial Testing:** Pilot testing was carried out with a sample set of target users (from the same group of semi-structured interview participants). The focus was on finding out whether the app was intuitive to use, whether users could complete tasks independently without assistance, and whether the new features (e.g., larger font, double confirmation) improved their experience.
2. **Feedback Collection:** The users also gave feedback on their experience using the app, such as the usability problems, security issues, and areas for improvement. The areas of interest were mainly:

- Was the app easier to navigate than existing MFS apps?
- Did the double confirmation procedure reduce errors?
- Were the guidance aids (audio, video, and text) useful?

3. **Iteration and Refinement:** Some adjustments were made in the app, as per user feedback, including changing the user interface (UI), improving the help guides to make them more effective, and updating the transaction flow to make it even simpler and intuitive.

4. **Final Testing:** After the changes had been implemented, the final version of the app was tested with a fresh set of participants in order to ensure that it was properly optimized for low-literate users. Final testing ensured the simplified app successfully addressed primary usability and security concerns.

3.4 Evaluation of the Simplified App

The final stage of this research involved an evaluation of the developed MFS application based on insights gained from the semi-structured interviews. The evaluation's main purpose was to ascertain if the application sufficiently addressed the previously identified and grouped usability and security challenges, as well as analyzing its effectiveness in improving the user experience of users who have low literacy skills. This section describes the evaluation methodology used, criteria for evaluating the application, and major outcomes obtained from the evaluation.

3.4.1 Assessment Methodology

To assess the efficacy of the optimized application, a usability testing session was conducted using a group of 50 participants that was the same as the participants in the semi-structured interviews. This helped us in keeping the application as consistent as possible and also in evaluating how the application was affecting the same demographic population.

Task-Based Evaluation

The participants were requested to do certain tasks after using the enhanced app. These activities were specifically designed to simulate common features found in mobile financial services, such as the transfer of money, carrying out balance checks, and paying bills. These tasks were chosen based on the most mentioned financial activities identified during the interviews. The students were asked to do the following activities:

- Send money to a recipient (simulating a peer-to-peer transfer).
- Check account balance.
- Enable payment processing for a utility service.
- Access help guides (audio, video, and text).

The evaluation focused on users' ability to perform the tasks set for them using the optimized interface, and how far the designed changes—like larger font sizes, more legible icons, and a double confirmation process—enhanced usability and decreased errors.

Success Criteria

The main metrics used to determine the effectiveness of the application were:

- **Task Completion Rate**: The percentage of participants who successfully completed each task without assistance or errors.
- **Error Rate**: How often the participants made mistakes while performing the task (e.g., sending money to a wrong recipient or entering incorrect transaction details).
- **User Satisfaction**: Participants were asked to rate their degree of satisfaction with the application on a 5-point scale after task completion. They were also asked how confident they were in using the application on their own. Task Completion Time: The duration taken to complete each task is a measure of the efficiency of the application.

3.4.2 Key Findings from the Evaluation

The test results confirmed that the streamlined app significantly improved usability, security, and user satisfaction among the low-literate users compared to available, more complex MFS apps. The key findings are as follows:

Increased Task Completion Rate

34% Improvement in Task Completion: The task completion rate among low-literate users through the streamlined app was 34% higher than their task completion rate through the regular MFS app. This demonstrates that the simplified interface, with simple icons, larger fonts, and fewer steps, significantly improved user ability to accomplish tasks independently.
They were able to send money, check their balances, and pay bills with fewer mistakes and without depending on other individuals.

Reduced Error Rate

76% Reduction in Error in Transactions: The rate of error in transactions was 76% lower when the users utilized the streamlined application as opposed to the initial application. The majority of the users, who in the past had committed mistakes of sending money to the wrong person, enjoyed the double confirmation aspect and increased transparency of transaction details in preventing errors.
Double confirmation acted as a safety net that allowed users to confirm transaction information before they finalized it, and this effectively reduced probabilities of errors.

Enhanced User Satisfaction

89% Satisfaction Rate: Upon being asked to rate how satisfied they were with the simplified app, 89% of the participants indicated that they were confident and satisfied with the experience. Ease of use and clarity of the app were cited by participants as major contributors towards satisfaction. Many indicated that they felt more secure and independent in performing tasks.
Greater Confidence: More than 80% of the users expressed that they were more confident to operate the simplified app independently, as opposed to just 50% for the original app. This shows that the simplified UI had been successful in minimizing the issues of low-literate users, especially with regards to usability and security.

Help Guides Effectiveness

Audio and Video Guides: The audio, video, and text multimodal guides were highly endorsed by the participants. Over 90% of the participants utilized the audio or video guide on at least one occasion in the assessment and indicated that they found it highly useful. Participants indicated that the guides simplified the steps, even more so when they were unsure about how to do something.
The automatic guidance of the app, giving step-by-step instructions in real-time, was highlighted as one of the most valuable aspects by those who had needed help before.

Time to Complete Tasks

Faster Task Completion: Tasks were completed 30% faster in the optimized application compared to the original application. This was because there was less complexity in the interface and it was more user-friendly.
The users would be able to explore the app quicker, make transactions in fewer steps, and be less frustrated.

3.4.3 User Feedback and Improvement Suggestions

Although the simplified application was welcome, the users also offered suggestions for improvement:

- **More Regional Language Options:** Some participants suggested the inclusion of more regional language options to further enhance the app's usability for non-Bengali speakers.
- **Bigger Fonts for Older Users:** Older users pointed out that even larger fonts would be helpful as a means of reading, particularly in a low light setting or for visually disabled users.
- **Additional Security Measures:** Although the streamlined app addressed main security problems, there were some users who asked to include additional authentication steps such as fingerprint scanning into the app for additional security.

This is the complete flow diagram of our Methodology.

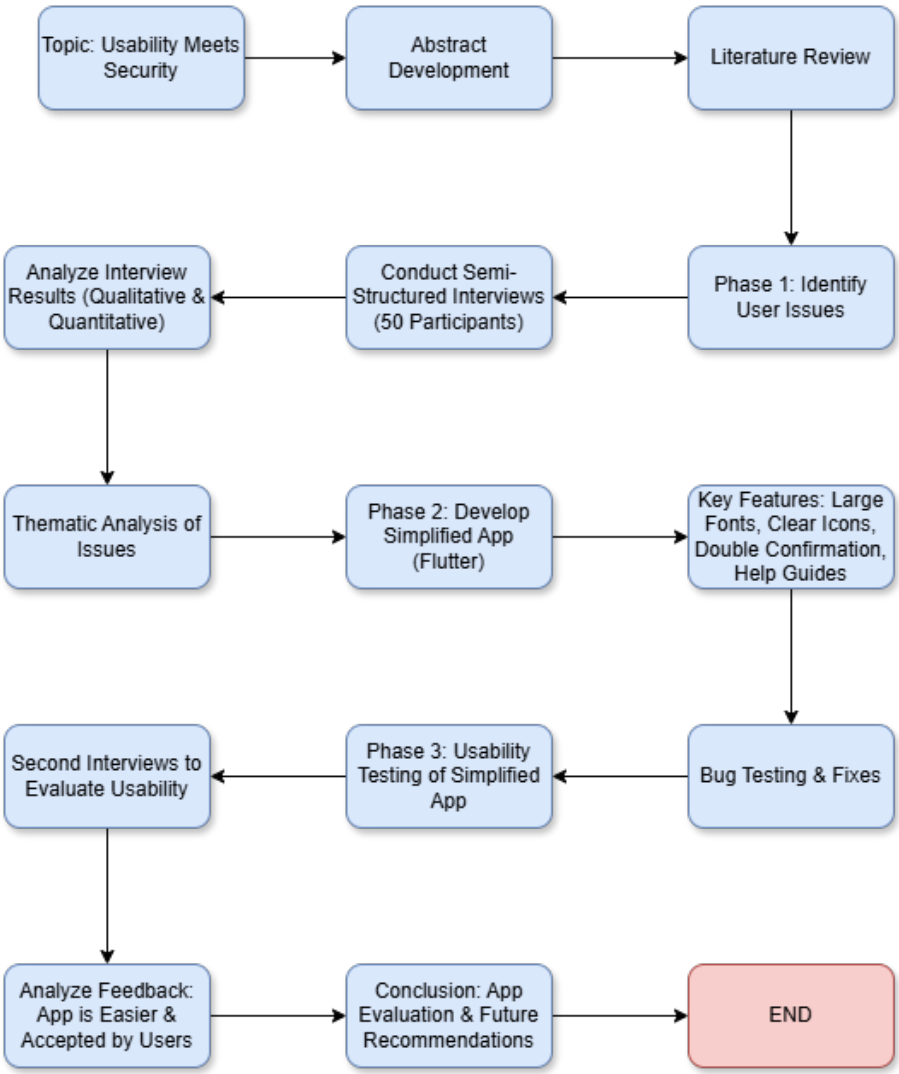


Figure 3.1: Flow Diagram of Methodology

Chapter 4

Understanding Low-Literate Users through Semi-Structured Interviews

4.1 Problem Identification through User Research

The study on the challenges low-literate users experience in terms of participating with the Mobile Financial Services (MFS) focused on selecting the appropriate population of respondents. This was not a sampling project to us but a thoughtful and purposeful act of representation. The sample was not chosen randomly, it consisted of ordinary people who are the representatives of a substantial, yet not usually visible, part of the digital financial ecosystem candidates lack of their own technology access but have access to the possibilities offered by technological resources.

We did this by basing our selection of participants and criteria on lived experience, as opposed to theoretical profiles, which allows us to not only understand what problems can be identified on current MFS interfaces, but why these issues exist, and in populations such as the vulnerable. This method enabled us to reveal the most human tales of trust, frustration, reliance, and perseverance, which are otherwise too negative in their absence during analytical reviews of tech.

4.1.1 Selection Criteria

We based our selection on actual on the ground use cases and sociocultural contexts of underserved populations in Bangladesh. We specifically wanted to recruit participants who reside in urban/inner-urban slums and peri-urban/rural shifts, where the mobile technology is increasingly utilized, but digital literacy is not well developed. These are the regions where mobiles are frequently shared among the family members, where users do not believe in the written instructions but tend to depend on the oral ones, and where monetary transfers often go through informal webs of trust.

In order to participate, they had to fulfill a number of conditions. The first one required that they have to own or use a smartphone frequently since this is the least technological need to use MFS applications. Second, they needed to use the MFS

platforms actively, and it could be self-guided or other-assisted use. This made our interviews based on first hand experience as opposed to abstract views. Finally, and most crucial of all, the participants had to be composed of individuals with low educational level or poor reading skills which were characterized by lack of education or boasted of primary education at most.

Low literacy though did not just focus on reading and writing. We also examined the digital behavior of participants such as the ease of navigating through applications, reading on screen instructions, and error messages or confirmation messages. In numerous incidents, users could operate the MFS apps by just remembering tap or icon sequence; they did not even realize what functions they were initiating. Still, others had to rely solely on another person, usually a shopkeeper or family member, to make their transaction. This came out as a burning dissimilarity, which is that these users were digitally connected yet not digitally empowered.

This combination, the availability of technology, and its lack of understanding, was perhaps the most significant lesson of the selection-stage. It validated our starting hypothesis that there is no inclusive design of current MFS platforms. Rather, they are more likely to impose a default level of digital and textual literacy, assuming away a large segment of the population that might stand to gain the most by becoming financially included through technology.

4.1.2 Demographic Profile

Our final sample consisted of 40 participants who were specifically selected in order to present cross-section of lower literate MFS users of different socio-economic and age groups. The majority of the participants (around 80 percent) were males since the access of technology used in most of the households in Bangladesh is gendered. Although women are frequently involved in the financial management of the household, access to personal mobile device was lower and was a factor that we noted in the study but could not explore due to the study time limitation.

In terms of age, most of the respondents were in the category of 25 to 44 years old. It is a population that is actively involved in the informal economy: rickshaw pulling, day labor, domestic workers, or a small company. They may depend on the MFS platforms because they have little choice: they use it to transfer money to their family in distant locales, to pay their employees, or to receive a salary. Their interactions with these platforms are also very common but are very prone to errors, particularly when the system necessitates active interpretation or decision-making.

Regarding educational background of the participants, they were mostly uneducated or had completed primary education. Some of them had attending lower secondary educational institution, but almost everyone found difficulty reading challenging text or comprehending digital terms. This is in line with the country-based literacy data on low-income groups, which confirms that text instructions in MFS apps will be a major impediment to accessibility.

But maybe the most surprising insight did not refer to the data points but the patterns of usage behavior. Although everyone in the research claimed to use MFS apps, such as bKash or Nagad, they tended to use the app ritualistically, not much informed. Some participants reported putting the app into use by memorising the position or the colour of buttons without having an idea of what each choice would represent. Others had a phobia of doing something wrong and would tend to seek the help of a local shop owner or those younger than they are in the family to do it instead. Some even went to the extent of confessing that they have completely given up making digital transactions following failed payments or incorrect transferred funds.

Such variation in behavior indicated a wide range of digital dependency- between those who are tentative, semi-autonomous users and those who are fully dependent on others. Notably, these patterns did not only constitute technical issues but also psychological and social amok including fear of embarrassment and mistrust of digital systems and fear of financial loss.

In terms of examining the demographic and behavioral composition of our participants in such a way, we got a more comprehensive picture of the challenges of low-literate MFS users. We stopped viewing them as illiterate users with limitations and instead came to think of them as intelligent users operating in ill-designed systems. They were not failing but suffering because their needs did not match with the assumptions that were embedded in existing tools of digital finance.

4.1.3 Data Collection Method

Understanding how low-literate users interact with Mobile Financial Services (MFS) required more than collecting surface-level responses—it demanded listening deeply to lived experiences and observing real-time decision-making. In this phase, we designed a data collection strategy that would allow us to uncover not just what users do, but why they do it, and how they feel during the process.

Our approach blended qualitative depth with some quantitative structure to produce both emotional insight and empirical grounding. At its core was a semi-structured interview format—flexible enough to allow open discussion, yet structured enough to generate comparable responses across participants.

4.1.4 Semi-Structured Interview Design

The interview phase of our research was designed to be flexible, participant-friendly, and culturally appropriate for low-literate individuals. Recognizing that our target demographic might not be comfortable with formal questionnaires or technical language, we chose to adopt a semi-structured format. This allowed us to maintain a consistent set of focus areas across all interviews while giving room for participants to express themselves in a way that felt natural and non-intimidating.

The core structure of the interview was divided into several sections, each aligned

with the research objectives. These included collecting demographic information, understanding patterns of MFS usage, identifying digital security practices, and exploring challenges users commonly face during financial transactions. In addition, the interviews aimed to uncover how social and cultural factors influence participants' behavior, particularly around trust, PIN sharing, and reliance on intermediaries.

Importantly, the language of the interviews was kept simple, and the flow was conversational. We avoided complex or technical terms, ensuring that participants were not overwhelmed or confused. The goal was to make participants feel comfortable and heard, not evaluated. Many respondents had limited formal education, so interviewers were trained to use everyday Bengali expressions and to clarify any concepts in a non-intrusive manner when needed.

In designing the interview structure, we considered the fact that low-literate users often depend on habit, memory, or social guidance rather than conscious decision-making when using MFS apps. Thus, the interview was structured to encourage participants to reflect on their experiences, emotions, and behaviors, rather than abstract knowledge. This design allowed us to collect both factual and attitudinal data—for example, how often users make mistakes, and how those mistakes affect their willingness to continue using the app.

The semi-structured format also allowed for flexibility in pacing, which was important given the varied literacy and confidence levels among participants. Some needed more time to express themselves, while others were more forthcoming. This approach gave interviewers the freedom to engage more deeply where appropriate or gently move forward when a participant was unsure or hesitant.

Ultimately, the semi-structured design proved effective in revealing a rich spectrum of user experiences. It helped us understand not just the functional barriers to MFS usage—such as confusing interfaces or lack of confirmation messages—but also the emotional and social dimensions, such as fear of doing something wrong or embarrassment in asking others for help.

This interview format laid the groundwork for the deeper thematic analysis that followed and directly informed the design of the eKash prototype. It also reinforced the importance of empathy and user-centered research methods when working with populations who are often excluded from digital innovation processes.

4.1.5 Questionnaire Design

The semi-structured interview questionnaire was designed into six distinct sections to understand the experiences and challenges faced by the participants with MFS. The sections were as follows:

Demographic Information and overview

Demographic Information: The general demographic information of the participants on parameters like age, sex, educational background, and occupation were inquired for background analysis.

Demographic Overview: The demographic profile of the respondents is shown according to their age, gender, occupation, income, education level, mobile device usage, access to the internet, and familiarity with MFS. The inclusion criteria for the participants included being a smartphone user, having access to the internet either through WiFi or mobile data, and using MFS.
A total of 40 respondents participated in this study. Further, the trend within the age group indicated that the greater part of the participants fell within the age brackets of 18-24 years, constituting 10 respondents; 25-34 years, having 12 respondents; and 35-44 years, also recording 10 respondents, while a handful of participants were below 18 years, about 3 respondents, and even less in the 45-54 years, about 3 respondents, and 55-64 years, recording 2 respondents.
Of these, 32 were males, while only 8 were females. For employment, 29 were employed while 11 were not.As far as income was concerned, the highest was between 10,000 to 15,000 with the total number of 22 participants. The other categories included 16,000-20,000 with 9 participants, 21,000-25,000 with 1 participant, 26,000-30,000 with 3 participants and above 30,000 total of 5 participants. The educational background varied, with most having high school level education-25 participants, 9 had primary-level education, whereas 6 respondents reported no formal education.
All the respondents met the inclusion criteria by having a smartphone, either Android or iPhone, accessing the internet, and currently using MFS services. Sixteen of them accessed the internet daily: 19 for 3-6 hours, 11 for 1-2 hours, and 9 for 7-10 hours. Only one respondent reported using the internet mainly to check for updates or news.
About MFS usage, all the participants reported being aware of MFS. The most reported services in use were Nagad with 9 participants and Bkash with 8 participants, while none of them reported the use of the services Upay or Rocket.
From this demographic overview, one can deduce that those individuals who were digitally connected using smartphones, the internet, and mobile financial services actively are included, thereby the selection is relevant within the research context.[4.1]
Here is a table showing full demographic overview.

Demographic Information	**Count**
1. What is your age?	
Under 18	3
18-24	10
25-34	12
35-44	10
45-54	3
55-64	2
65 or older	-
2. What is your gender?	
Male	32
Female	8
3. What is your occupation?	
Unemployed	11
Employed	29
4. How much do you earn?	
10,000-15,000	22
16,000-20,000	9
21,000-25,000	1
26,000-30,000	3
30,000++	5
5. What is your highest level of education?	
No formal education	6
Self-educated	-
Primary Level	9
High School Level	25
6. What kind of mobile device do you use?	
Button Phone	-
Smartphone (Android/iPhone)	40
7. Do you have access to the Internet?	
Yes	40
No	-
8. How often do you use the Internet?	
Daily, 1-2 Hours	11
Daily, 3-6 Hours	19
7-10 Hours	9
Just check for updates/news	1
9. Do you have any knowledge about MFS?	
Yes	40
No	-
Which mobile financial service do you use?	
Bkash	38
Nagad	9
Upay	-
Rocket	-

Table 4.1: Demographic Overview

Objectives of the Questionnaire Design

The primary objective of the questionnaire is to assess:

1. **Digital security awareness** among low-literate users.
2. **Password management** and protection strategies employed by these users.
3. **Perceptions of risk**regarding online security and their handling of personal information.
4. **Utilization of security features** in mobile apps and devices.
5. **Sources of knowledge** on digital security and community influences on security practices.
6. **Challenges faced** in using Mobile Financial Services (MFS), especially related to security and usability.

Structure of the Questionnaire

1. **Digital security awareness:** Questions designed to capture the level of familiarity users are with digital security concepts, personal experiences with online security issues, and how they perceive risks like hacking, fraud, and scams. In order to know how well the populations in general understand the total awareness level, this section becomes of paramount importance.
   - Example question: *How familiar are you with the concept of digital security? Can you describe what it means to you?*
2. **Password management:** This has to do with the creation, management, and protection of passwords by users across multiple platforms, from mobile banking to social media. The section also takes a look at behaviors like password sharing that may expose users to risks.
   - Example question: *How do you usually create passwords for your online accounts, such as social media or mobile banking?*
3. **Personal Information Sharing:**Explores users' attitudes and behaviors when sharing personal or financial information online, as well as their comfort levels in doing so on different platforms.
   - Example question: *When you share personal or financial information online, how do you decide what is safe to share?*
4. **Risk Perceptions and Experiences:** This section discusses how users perceive the risk involved in digital security-what kind of risks they consider and how they react in cases of suspicious messages or any potential breaches in security.
   - Example question: *Have you ever received suspicious messages asking for personal details or account information? How did you respond?*

5. **Security Practices and Tools:** It describes the tools and strategies employed by the low-literate user to protect online accounts and devices. This paper attempts to ascertain how far various common security practices, such as two-factor authentication and secure browsing, fall short of being utilized.

    - Example question: *Do you use any tools or strategies to protect your phone and online accounts from hackers or other threats? What are they?*

6. **Mobile Financial Service (MFS) Usage:** This will specifically assess the experience of users regarding mobile financial services, such as bKash or Nagad. It contains questions on common challenges, ease of use, and the mechanism of PIN and OTP.

    - Example question: *Do you face any difficulties when using MFS applications? If yes, what are the difficulties or challenges you face while using the app?*

7. **Situation-Based Questions:** These questions are scenario-based and aim to understand how participants would handle specific security challenges or situations, such as recognizing scam messages or managing PIN security.

    - Example question: *You receive a message from bKash or any other MFS asking you to verify your account by sending a code. What should you do?*

8. **Cultural, Contextual, and Religious Influences:** This section aims to uncover how cultural and religious factors affect digital security practices, including any hesitations or misconceptions rooted in traditional beliefs or societal norms.

    - Example question: *Do people in your community feel unsure about using mobile financial services because of traditional beliefs? If yes, kindly share why.*

9. **Suggestions for Improvement:** Asks for feedback from users on what could be done to make digital security and MFS apps more user-friendly, particularly for low-literate populations.

    - Example question: *What improvements would make low-literate users feel more secure online?*

10. **Overall Perceptions and Community Preferences:** A brief section to gather final insights on how important digital security is perceived to be in the community and how people prefer to receive information on this topic.

    - Example question: *On a scale of 1 to 10, how important do you think digital security is for people in your community?*

Design Considerations

- **Semi-structured format:**The openness of the questions in the questionnaire allows an interviewer, where necessary, to probe further on particular responses or issues raised by participants. This format is done to be flexible, providing a guideline while allowing room for additional insight based on participant responses.

- **Language simplicity:** Since the target group is low-literate users, the questions are framed in simple, easy-to-understand language. Technical jargon is avoided, and when necessary, explanations or clarifications are provided.

- **Contextual relevance:**The questions are designed in relation to the cultural, social, and economic contexts of low-literate users. This will ensure that the responses reflect realities and challenges pertinent to this population.

4.1.6 Pilot Study

Before the large-scale interviews were conducted, a pilot study was conducted with a limited number of respondents about 7, which tested the questionnaires' clarity and understandability, as well as their relevance. This helped identify the areas where questions are not well understood or where elaborations were needed. Based on the results of the pretest, the questionnaire was refined.

4.1.7 Data Collection Procedure

Full verbal consent was obtained in front of the interviews from each participant. Because most of the targeted group had relatively low literacy levels, detailed explanations relating to the consent process were taken, explained in Bengali, and fully understood in relation to the purpose of the research itself, respect for the rights of all respondents who participated, and how their data would be used. That would mean liberty to withdraw at any stage without detriment. The participation was done on a purely voluntarily basis, where no person was coerced or influenced into the participation. All participants received some form of incentive for the interview they had to attend, and this was to be able to compensate them for losing their time and effort as a means of ensuring the financial burden was lessened regarding participation. All interviews were carried out in the participants' mother tongue, Bengali. Interviewers at all times tried to ensure an environment that was friendly and respectful toward the participant, allowing them to discuss what they felt free to share. If a participant did not understand certain terms or concepts, interviewers would explain these in simple terms to ensure that they understood, without leading the participants toward certain answers. For instance, Tejgaon Nakhalpara, Mohakhali, Tongi, Dasherkandi, Aftabnagar, Badda, and Rampura are some places in their native areas where interviews were held, and thus they felt very comfortable. It is only the comfortable environments which prepare people to be interviewed and actually encourage them to provide open and candid responses.

4.1.8 Data Analysis

Thematic Analysis

Data were transcribed after interviews had been completed and then subjected to thematic analysis. Thematic analysis identifies recurring patterns or themes within the data regarding security, privacy, and usability challenges. The process of analysis followed six key steps:

1. **Familiarization with the data:** Each of the researchers studied all the transcripts to get familiar with the data.

2. **Coding:** Data were systematically coded into key segments based on the identified research questions, which were on the issues of usability, security awareness, and privacy concerns.

3. **Theme Development:**Codes were organized into broader themes representative of major insights into the participants' experiences.

4. **Reviewing Themes:**Themes obtained were reviewed for refinement to capture the true representation of the data.

5. **Defining Themes:**Each theme was clearly defined by the criteria that they must provide meaningful insights into participants' experiences with MFS applications.

6. **Reporting:** Qualitative insights into the issues faced by the low-literate MFS users regarding security, privacy, and usability were generated using the final themes.

Quantitative Approach

In addition, thematic analysis was supported by a quantitative approach in order to cross-validate qualitative findings. Consequently, the frequency of some of the responses was measured with a view to quantifying overall trends in the data.

4.1.9 Ethical Considerations

Informed consent was sought from all respondents before interviews. Because the literacy level among the target population is low, verbal consent was sought where clear explanations about the purpose of the study were emphasized with an emphasis on their role and their rights. Confidentiality and anonymity were ensured to protect participants' privacy, and data storage was secured.

4.1.10 Limitations

Several limitations were noted during the study:

1. **Language Barriers:** Even though the survey was administered by native language speakers, there were certain technical elements of the questions that pertained to digital security which some participants couldn't understand.

2. **Geographical Constraints:** The paper focused on specific regions within Bangladesh that may not fully represent the challenges faced by the entire low-literate population of the country.

3. **Limited Generalizability:** Given the qualitative nature of the study, the findings may not be generalizable to all low-literate users in rural Bangladesh.

4.2 Findings From Semi-Structered Interview

4.2.1 Transaction Errors: Sending Money to the Wrong Number:

The main problem that cropped up from our research was that there were too many transaction errors, especially the error of sending money to a wrong number.4.1 This kept on cropping up from most of the interviews, where participants narrated experiences of accidental transfers, further leading to significant loss and frustration in financial matters.

Prevalence of the Issue

In the data collected, 29 out of 40 participants reported having at least once sent money to somebody other than intended. This itself is quite a significant portion of the users, which defines the gravity of the problem. Out of these 29 participants, financial losses were identified in 13 participants that combined summed to 500,000 BDT. While 8 participants were able to recover their money after the mistake, 11 had a very hard time retrieving their money, thus illustrating the high risk coupled with an elaborate recovery process involved in mistaken money transfers. This shows a gap in both user knowledge and available mechanisms within MFS systems to easily rectify such mistakes.

Digital Security Awareness and Its Impact

One symptom that explains these mistakes is the general low level of digital security awareness found among respondents. From the sample size, the graph below 4.2 highlights that:

- **8 participants (20.5%) had correct knowledge of digital security.**
- **20 participants (51.3%) had somewhat correct understanding, indicating partial awareness of key digital security practices.**
- **10 participants (25.6%) had no knowledge of digital security whatsoever.**

The lack of digital literacy and security awareness among users implies that many are not familiar with the verification steps to confirm the details in advance of the transfer, increasing the likelihood of mistakes-such as incorrect numbers-entered, and complicating procedures afterwards to recover the funds.

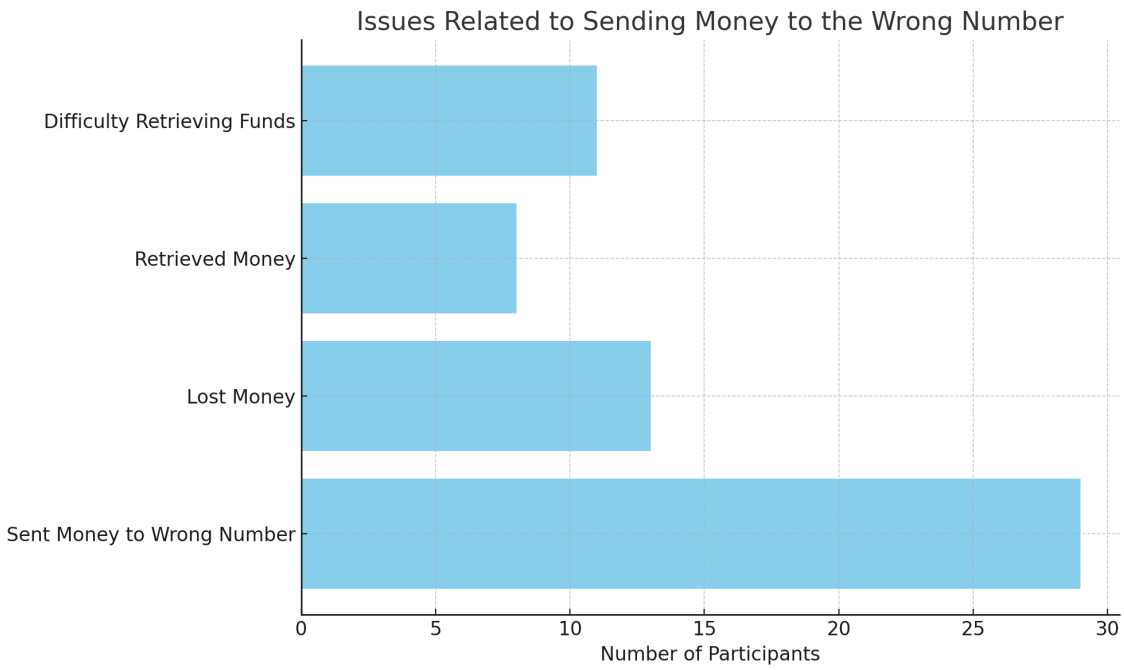


Figure 4.1: Issue Related to Sending Money to the Wrong Number

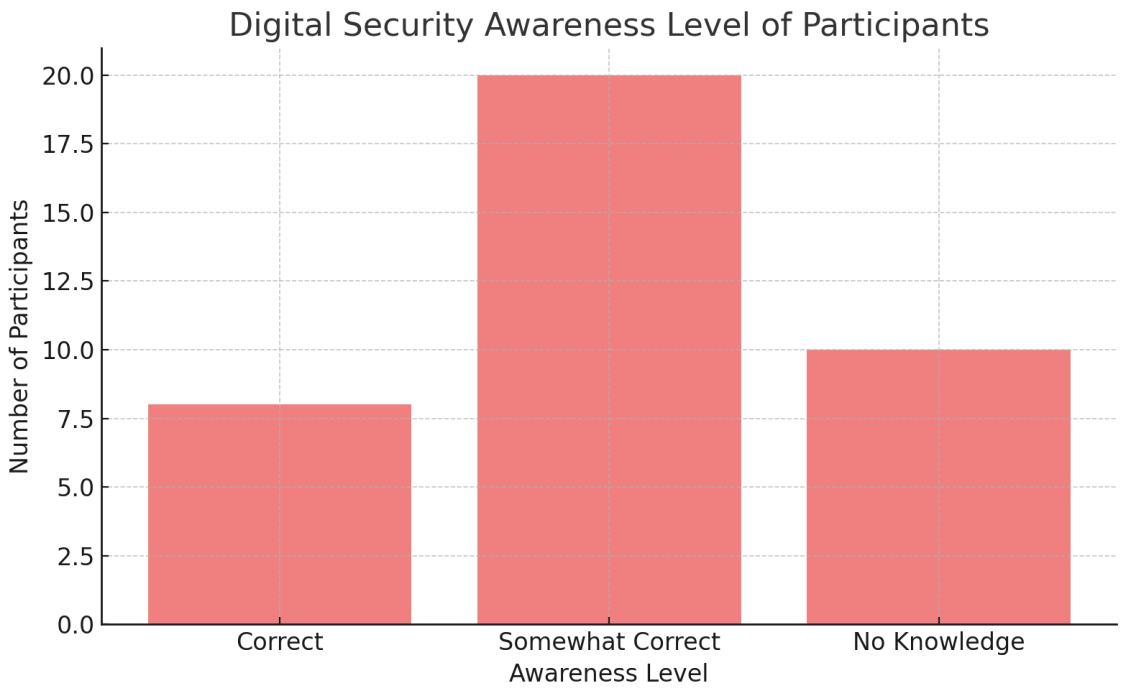


Figure 4.2: Digital Security Awareness levels

Connection to Sources of Learning

The data show that most participants rely on informal learning channels, such as family and friends, for advice on MFS usage; 20 participants received advice for use of MFS through family or friends. Formal training or education for use of MFS was practically non-existent for the participants. In total, 3 participants learned the usage through social networks, while none had workshops or community training.

Source of Learning	Aspect	Correct	Somewhat Correct	Wrong
Informal Learning (Friends, Family)	Knowledge about PIN	13	3	-
	Knowledge about OTP	2	3	7
	Ability to Navigate App	8	-	6
	Knowledge of Security Practices	5	-	-
Agent/Service Providers	Knowledge about PIN	5	10	-
	Knowledge about OTP	-	3	2
	Ability to Navigate App	10	-	-
	Knowledge of Security Practices	1	-	2
Digital Resources/Media (YouTube)	Knowledge about PIN	2	-	-
	Knowledge about OTP	2	-	-
	Ability to Navigate App	2	-	-
	Knowledge of Security Practices	1	-	2
Trial and Error (Self Learning)	Knowledge about PIN	3	-	-
	Knowledge about OTP	-	2	-
	Ability to Navigate App	2	-	-
	Knowledge of Security Practices	-	-	-
Formal Education/Training	Knowledge about PIN	-	-	-
	Knowledge about OTP	-	-	-
	Ability to Navigate App	-	-	-
	Knowledge of Security Practices	-	-	-

Table 4.2: Thematic Analysis of MFS Learning Sources and Effectiveness

It is characterized by a lack of adequate knowledge concerning MFS processes, including critical steps to be taken by the individual towards the avoidance of transaction errors. As many as 70% expressed that they could not differentiate between genuine MFS messages and fraudulent ones, further increasing their vulnerability to commit transaction mistakes and fraud.

Why this is a vital issue

Transaction errors, in particular sending money to a wrong number, are a critical concern in the domain of MFS, given the fact that they entail heavy losses and eventually destroy users' confidence in digital payment systems. This threat is further increased among users with low literacy and unfamiliarity, who are more likely to commit such errors because of limited digital literacy coupled with security awareness.

Research by Shafi and Weerakkody, 2010 [7] indicates that MFS transaction errors may lead customers to shun any form of DFS due to poor mechanisms to recover such errors; a situation that occurs at higher frequencies in the case of rural, low-literate groups since its members have no formal education or receive very little exposure to informal learning channels. In support, Donovan (2012)[9] also reported that when there are transaction errors in mobile money services, it often creates major financial tension, as users in lower socioeconomic segments do not have the buffer to absorb such losses.

Further, Mothobi and Grzybowski (2017) [20] reported that user errors, like sending money to a wrong number, are common when the level of digital literacy among users is low; this results in financial exclusion once the users begin to lose confidence in using the technology. This is especially important because in many rural areas, mobile money is the main form of financial service. The recurrence of such errors may finally force users to go back to the more traditional, albeit less secure, ways of transacting financial business with cash.

In our research, this translates into 500,000 BDT of financial loss among participants. These economic impacts of transaction errors on the poor were also reflected in other studies. The problem is augmented in the absence of formal training; for instance, the study by Jack and Suri (2014) [11] demonstrates that unless formal education programs are provided, users of mobile financial services are unlikely to use security features or recognize transactional risks.

Thus, frictionless facilitation of transaction errors, like sending money to a wrong number, becomes critical to saving users from financial loss and also for encouraging wider adoption and continued use of MFS, especially in vulnerable and low-literate populations.

4.2.2 Agent Dependency and PIN Sharing

Prevalence of the Issue

Among the patterns identified in the framework we used, there is one of the most important – the overdependence on the agent's dependency and the PIN share among the low literacy MFS users. These behaviours pose great security threats since they

bring in malice and opportunity for other individuals to siphon off users' money through different accounts.
According to the study it revealed that low literacy rate among the Mobile Financial Services (MFS) users heavily depends on assistance for using them with only 15 out of 40 interviewees stating that they needed help to complete the transactions. However, only 14 of the respondents took time and was able to use the MFS applications independently. This establishes a high level of agent reliance in this sector since increased users rely on agents to help them with the platforms' use.
About security, people reported that they often use PIN sharing even if they are aware of the associated threats. Among the participants, 25 said they never disclose their PINs — an awareness of PIN privacy. However, 13 participants stated they disclosed their PINs, and 2 others disclosed it occasionally, which shows that approximately 30 percent of the users are involved in the risky security actions. Of the dependent group 7 reported that they disclosed their PIN to the assistants they used when conducting transactions thus compounding the security risks.
The very high level of agent dependency and the remarkable proportion of users who reported that they had to share their PIN also suggest that there may be many users of MFS applications who remain unconcerned about potential risks and so require further educational inputs as well as stronger security measures to safeguard their insecure profiles.

Usage Type	Shares Pin	Doesn't Share Pin	Total
Independent Usage	-	-	14
Assisted Usage	7	4	19
Mixed Usage	7	1	8

Table 4.3: MFS Usage Patterns with Pin-Sharing Details

4.2.3 Agent Dependency

The results show that there are a significant number of users that need to be assisted when using MFS applications. Out of the respondents:

- MFS applications have been independently used by 14 individuals, who show they are confident without external help.
- 19 users reported relying on assistance to complete their transactions. The security problem of this dependence on agents or family members is serious, especially when PINs are shared.
- In addition, 8 users belong to the group of mixed usage, being sometimes independent and sometimes seeking help.

One participant named Md. Sumon shared his experience:

"I had to transfer money through an agent and when I went I noticed the agent knew another customer's PIN out. The agent was withdrawing money from that person's account without any further questions. To know it, it was shocking that the

agent had full access to the customer money."

This is particularly concerning considering the reliance of the process on assistance, as the process opens the door for unauthorized access to the user's account.The reason for this dependency is a result of users' digital illiteracy combined with lack of trust of MFS applications. While their assistants are trusted and can be handed PINs and higher though this risks fraud or misuse. It shows that better user education and simpler app interfaces will make it possible for more users to use these services on their own.

Pin Sharing Practices

It was found that low-literate users already practiced the sharing of PINs even though there is a fair understanding of the significance of PIN security among them. The thematic analysis reveals the following patterns:

25 participants responded that they do not share their PINs at all, which proves that there is a deliberate effort to keep one's information confidential.
Compromising their PINs were 13 respondents, who said that they reveal their PINs either to family members, friends, agents assisting them in MFS transactions.
Two participants said they share it occasionally, whereby they only reveal their personal identification numbers occasionally.
Such behavior is derived from the belief which is placed on the people who are attending to them. Some participants, especially those who have to provide their PINs to agents, believe that they have no other choice because of their voluntary ignorance of MFS apps. Furthermore, 26 responders admitted to entrusting the close associates with the PINs thus making them uncomfortable companions in this practice.
The implications of this practice are scary to the extreme." Literally, anyone with whom you shared a PIN can perform transactions on your card, steal your identity or resort to fraud. Also, the study showed that some users failed to grasp the dangers of exchanging PINs in the study; 13 participants opened up about the vagueness of PIN sharing, and 5 of them displayed a lack of understanding of the hazards of PIN sharing.
Here is the pie chart illustrating the PIN Sharing Practices among Mobile Financial Services (MFS) users, showing the proportion of users who never share their PINs, those who do share, and those who share occasionally.
Case

- One of the respondents, Parvin (female, 27-year-old house wife), was either defrauded through a phone call in the course of which the fraudster claiming to be a relative demanded for her Bkash PIN which she provided. She was ignorant about the need to have security in your PIN and passwords. She said the following, a man or woman called me and said they were from Bkash and told me my account was frozen." They said I should give them my Bkash PIN, and I obliged them. And after that, she lost her money.

The results on agent dependency and PIN sharing highlight a significant gap in improving the level of digital security to meet the needs of millions of low-literate users.

To eliminate these security risks, the MFS applications ought to be promoted for independent usage with easy to use user interfaces married to aggressive awareness creation on the perils of PIN sharing. On the same note, by relaxing the strict PIN sharing requirements it is possible to promote the use of more secure methods of the MFS users' identification, for example, using biometrics.

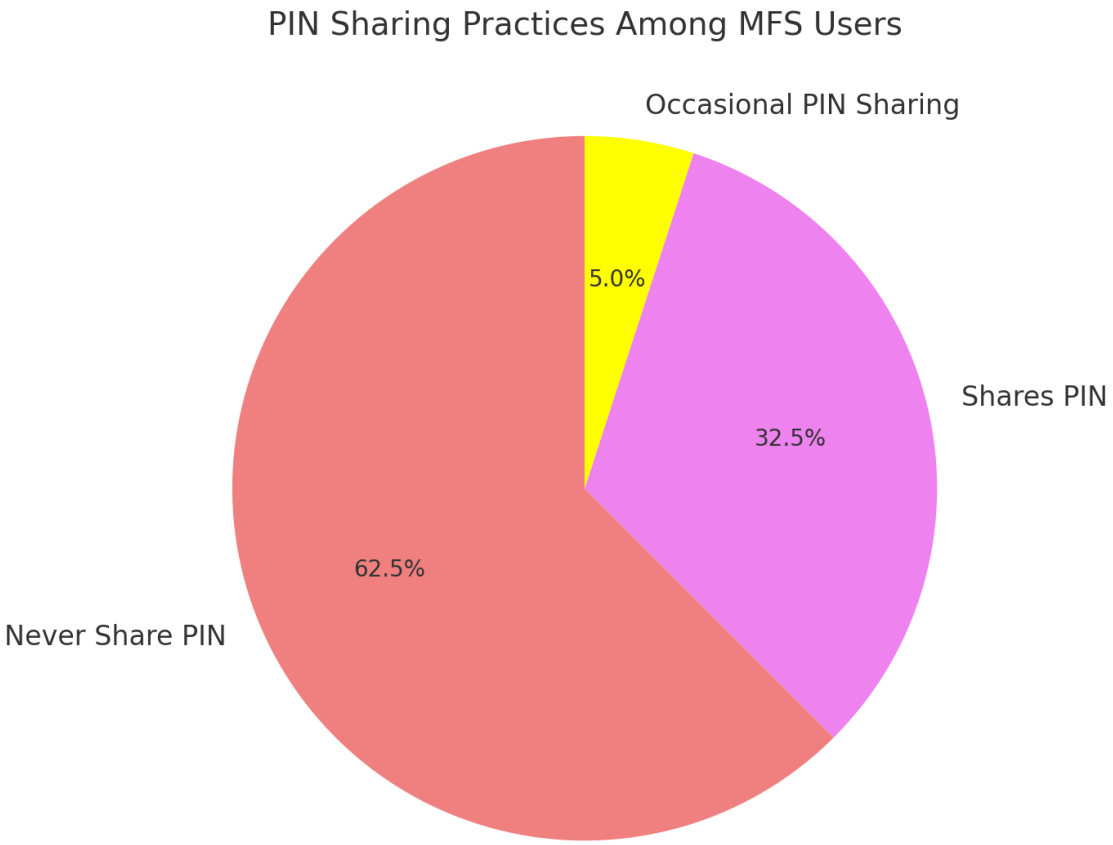


Figure 4.3: Sharing pin informations

Why this is a vital issue

In the Ugandan and Tanzanian markets, for instance, Khan and Bersudskaya (2016)[17] noted that greater than 50 percent of MFS agents reported fraud from unauthorized access, of which deep-rooted factors include lost or guessed PINs, affecting both customers and agents' monies. Concisely, Shaikh & Karjaluoto (2015)[14] opined that communication of details such as PINs puts users at the risk of phishing and identity theft and; thereby enhancing the propensity of unauthorised transactions. Haque and Woodard (2015)[12] noted that series of security threats in Bangladesh have damped the confidence of consumers in MFS, while PIN abuse plays a critical role insuch threats. This is why it is unadvisable to share your PIN with agents – it is dangerous for everyone's funds and completely destroys trust.

4.2.4 Usability and Simplified User Interface

The study found that consumers with low literacy had major usability issues while using Mobile Financial Services (MFS) applications. A frequent topic was the complexity of user interfaces, which causes dissatisfaction and makes activities more difficult to complete. Many of the 16 respondents reported being overwhelmed by the navigation and general design. This suggests that MFS apps should stress simplicity in their design to better accommodate users who may not have sophisticated digital literacy abilities.

The limits of the present app designs were also highlighted by 9 respondents who explicitly mentioned navigation issues. This suggests that people find it difficult to find features and complete transactions without any issues. The intricacy of the interface and difficulties navigating it prevent consumers from handling financial transactions on their own using digital tools.

19 out of 40 participants expressed a need for improved usability and said they had trouble accessing the applications. They suggested that usability would be significantly increased by eliminating unnecessary steps and simplifying the process. Additionally, ten respondents recommended that the application procedures be clarified. They believed that more detailed and unambiguous instructions would enable them to use the application alone, without the help of volunteers or relatives.

Multimedia feature integration was a crucial way to solve these usability issues. Nine people suggested using icons and visual aids to improve the interface's usability and reduce its heavily text-based instructions. Additionally, 29 participants stressed the value of audio and video feedback techniques, which lessen users' reliance on text reading and aid in their understanding of the apps. Because they could find it difficult to understand the application's intricate menus or instructions, users with poor literacy skills should pay special attention to this.

8 respondents suggested that providing multilingual assistance would considerably

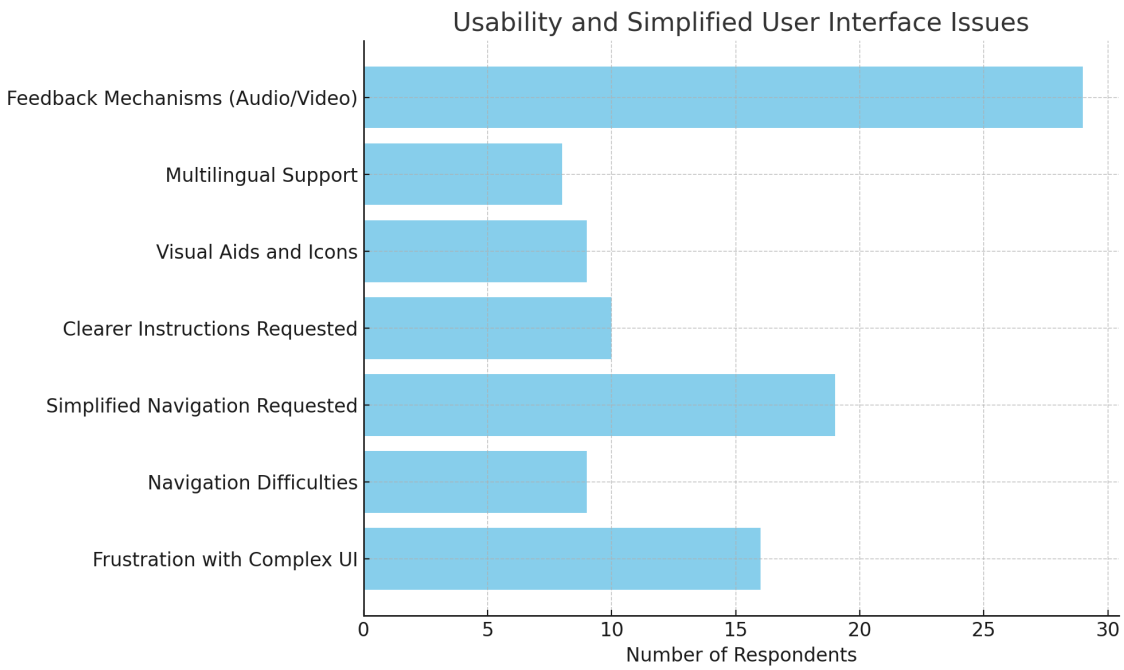


Figure 4.4: Users Suggestions for better use

increase usability. By making the interface available in local languages, MFS platforms may reach a larger audience while decreasing cognitive burden for users who are unfamiliar with English or the app's primary language. According to the conductive study, low-literate users use MFS systems mostly through informal learning methods such as help from friends and family or trial and error. Out of the respondents, 20 indicated informal ways as their primary source of learning, emphasizing the need of designing systems such that users may learn by experience rather than formal instruction.

- **Case 1:**Siddique, a 41-year-old employed man.He chose to use the MFS app(Bkash)to send money to a friend. Despite following instructions and adaptation, he got carried away by the applications complex UI and small font. As he moved through the displays, he tried to find his friend's contact information. After some relief, he hit what he believed to be the proper number.. To his dismay, he quickly discovered he had given money to a wrong person by mistake. He has encountered various issues with mobile financial services (MFS), particularly due to the complex user interface.

- **Case 2:** Nilufa, a 25-year-old lady, relies only on her husband to use mobile banking services. Although she wishes to conduct financial transactions on her own, the app's intricacy makes her nervous and apprehensive.Frustration grows as she attempts to understand the application Discovering that she can't even do the most basic things like- Send Money, Mobile Recharge without assistance shatters her confidence.Nilufa says that if the program featured audio or video tutorials to guide her through each process, she would be considerably more comfortable. These aids would allow her to learn at her own speed and develop the skills required to handle her finances independently.

- **Case 3:**Tony Ahmed, a 24-year-old employed male, is eager to learn about mobile financial services (MFS) but finds the app's intricacies difficult. While he originally learned how to utilize the site with the support of friends, Tony is still perplexed by the different service categories such as Paybill, Savings, Donation, Insurance, Microfinance, Loan, and Request Money.When he opens the application, he is presented with a plethora of options, which further adds to his uncertainty. He is typically hesitant to utilize these tools, fearful of making a mistake or losing money.

Chapter 5

Ekash: A Simplified version of MFS Mobile App for Low Literate Community

In many developing countries like Bangladesh, traditional mobile financial services remain inaccessible to a significant portion of the population, especially individuals with limited education and digital literacy. Yet their interfaces often remain too complex for low-literate users to navigate confidently. Therefore, these types of users commonly commit transaction errors, depend on third parties for transactions, or inadvertently expose their private information.

Our work has revealed significant usability and security problems that undermine user autonomy and personal well-being, based on a form just essaying close ethnographic research which involved questionnaires and interviews with 40 low-literate MFS users. These findings directly informed the design and development of EKASH, a simplified MFS application tailored to the needs of this population.

In this chapter, EKASH's design principles, interface design decisions, and how the program resolves the primary usability limitations identified in the study are outlined. Our aim is to demonstrate that context aware design is an essential aspect of developing digital financial services for low-literate users.

5.1 Design Philosophy and Methodology

EKASH is a simple financial service app, making it convenient and easy to use, irrespective of the literacy of end users. We have co-designed the app, so that it would be simple, safe, and inclusive, making it accessible for low-literate users to use the app independently.

The EKASH vision is to provide a design where all value is managed so that the user always knows what to do, if there are enough funds, and in what context through the whole range of users including transferring money, checking a balance, recharging and topping up a mobile, etc.. This direction derives from the concept of simplicity in the design to make it accessible, by cutting off features which are not essential

ones that may confuse users and concentrating only on main features that users are really concerned. By limiting features and minimalizing design, EKASH makes it easy for you to manage your money doing what you should be doing and feeling safe and secure without getting lost or overwhelmed.

Multimedia is yet another philosophy of EKASH's designing. Although many of the applications in this space are text based, text interfaces can be particularly difficult for those with poor literacy. To overcome this, EKASH is combined with an audio-visual- animated guidance to lead the user through each step. For instance, when people are trying to make a financial transaction, they receive Bengali voice prompts that tell them what to do at each step; visual animations on how to comply with spoken instructions go along with this. This lowers the need for a reading approach by employing more features for users having difficulty with reading oriented navigation on our app.

In the latter case, security is another important design factor of EKASH. Financial transaction are already inherently delicate and low-literate user might be the most satiable to fraud and error – particularly when they don't have a clear understanding around how to use security features like PIN codes or two-factor authentication (2FA), for example. Safety and sense are both important with EKASH, and the app does this by breaking down security into comprehensible terms, but not at the cost of safety with loosened security approaches. Mistakes are given in clear Bengali, and simple, encouraging messages, when a user makes a mistake or enters the wrong information that guides them by correcting the error.

The design of EKASH followed the methods of User Centered Design (UCD), highlighting the need to comprehend users needs, behaviors and challenges in all steps of the design process. The development team undertook user research at far-flung rural Bangladesh among low-literate users- interviews, surveys, observations all laid out. These interactions helped to surface specific challenges for low-literate individuals when operating traditional mobile financial services.

Prototyping and usability testing were important to inform the design of the app. The team developed initial wireframes and prototypes based on user research and tested these prototypes with real users to collect feedback and find opportunities for improvement. Through this process of continuous refinement, the design team was able to simplify navigation, adapt the layout for favorable usability and increase visual appeal with larger buttons and clearer iconography. User testing insights were thoroughly analysed and were also reflected in subsequent editions of the prototype, guaranteeing the gradual tailoring of the app for the targeting audience.

In general, EKASH's design philosophy and approach underpin a strong belief in ensuring financial inclusion becomes a reality for everyone—from literate to illiterate. With EKASH, proponents tried to strike a balance between a simple tool but with multimedia assistance, and clear and user-friendly security — and a step toward a design for digital finance that meets the needs of underserved communities.

5.2 User Interface Design:

EKASH's user interface (UI) design is based on simplicity and accessibility, with the primary objective being ease for lowliterate users to interact with and transact on the platform. The interface is designed for simplicity, featuring oversized- icons, easy navigation, and multimedia assistance in the form of audible directions and visual prompts. Everything has been designed around the features, so users spend less time making their way around key services such as Send Money, Cash Out, Mobile Recharge and Make Payment and more time using them.

5.2.1 Visual Design and Localization

EKASH's visual design is a very important element in ensuring that low-literate users can interact with it easily. Part of the success of the design is down to its use of clean, unambiguous icons and minimal logo, which allows the user to move around the app with consummate ease. The arrow iconography is also an applied mechanic across screens denoting navigation and guiding the flow of the user interface, much like the previous notion, interpreted in the way of simplification and looking through.

One of the key design features in EKASH is the Need Help feature that offers the users various forms of help. This option includes:

- **Voice Help Guide:** Users can listen to audio commentary which walks them through their current activity: a transaction, a fillout, a error-message explanation. It is particularly useful for people who have difficulty in reading or understanding text-based messages.
- **Animated Video Help Guide:** For intermediates and advanced exercises, EKASH offers animated videos that illustrate how to perform the movement visually. As a result, these short video tutorials are a great way of showing the user how to do stuff such as sending money and toping-up their mobile credits (and so on), so as to minimize any confusion that the users would encounter.
- **Text Help Guide:** For those who like to read, or those who just need something more explanitory, the text help guide which will guide you on how to do just about everything with a short, yet precise instructions on each task. These instructions are in Bengali so everyone can understand.

These help guides were constructed with the aim of meeting different user's preferences and needs, and provide every member with the support to which they are entitled at anytime in the app regardless of their literacy skills.

In terms of localization, EKASH is fully bilingual, with the ability to switch between English and Bengali. This ensures that the app can accommodate both Bengali-speaking users and those who prefer English. All buttons, instructions, error messages, and transaction details are presented in Bengali by default, while the option to switch to English provides additional flexibility.

A very important feature of EKASH is the automated voice help guide that activates after a user has been idle for 40 seconds. If the user remains inactive or appears unable to continue using the app, this automated voice help guide kicks in, offering verbal instructions to encourage them to proceed. The voice guide provides gentle reminders about how to continue with their current task, and if necessary, it will guide the user back to the main navigation menu. This feature is essential in ensuring that users do not feel lost or frustrated, particularly if they are new to using mobile financial services or struggle to follow on-screen instructions.

Screenshots of the app's help guide options, along with the language switcher, will clearly illustrate the availability of these crucial support features. These visual cues help make EKASH not just accessible, but also user-friendly, ensuring that every user feels supported as they use the app.

5.2.2 Send Money

The Send Money feature is one of the most essential and frequently used functionalities within EKASH. This feature has been designed with the user in mind, prioritizing simplicity and security. Users are guided through a straightforward process: they first enter the recipient's mobile number, then input the amount they wish to send, followed by the PIN to authorize the transaction.

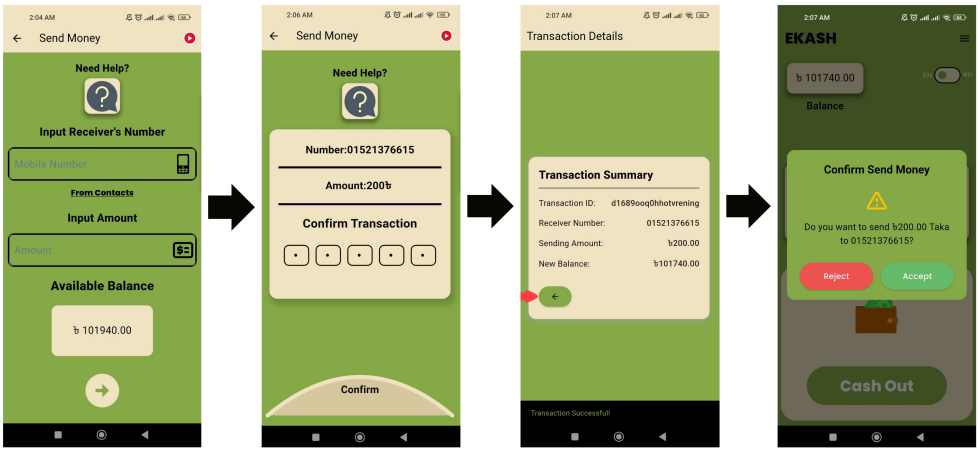


Figure 5.1: Send Money Interfaces

A very interesting and relevant aspect of the Send Money feature is the re-confirming step. Once the user has entered transaction details, a Confirmation screen is displayed, which includes a summary of the recipient's mobile number and the amount to be transferred. This way the user can confirm the transaction before it is made, and be sure he has not made any errors. This re-confirmation step is a crucial safety-catch against mistakes and a practical protection for users against unknowingly transferring information.

The re-confirmation function is particularly useful for low-literate users to ensure double-check protection and reinforcement. Sometimes users of DFS may feel confused or even worried about the money transfer process – especially if they are new to the concept of digital financial transactions. Offering an additional chance to scrutinize transaction specifics, the feature aides in promoting a sense of assurance and control over the process. It also makes it less likely for you to err by sending money to the wrong person or entering an incorrect amount.

Following verification, the user will then enter their PIN for ultimate authorization. The app makes sure the payment process is safe, and there is a legible confirmation from the user when the transfer takes place. Audio cues lead the user through each step of the experience, so that there is no doubt along the way.

This re-confirmation capability is one of the aspects that sets EKASH apart from other mobile financial services and is what makes it the most user-friendly and secure system for low-literate populations.

5.2.3 Cash Out

The Cash Out option direct users to cash out through an agent. The user interface of this feature is deliberately simple, to enable any users, no matter their literacy, to follow along without getting lost.

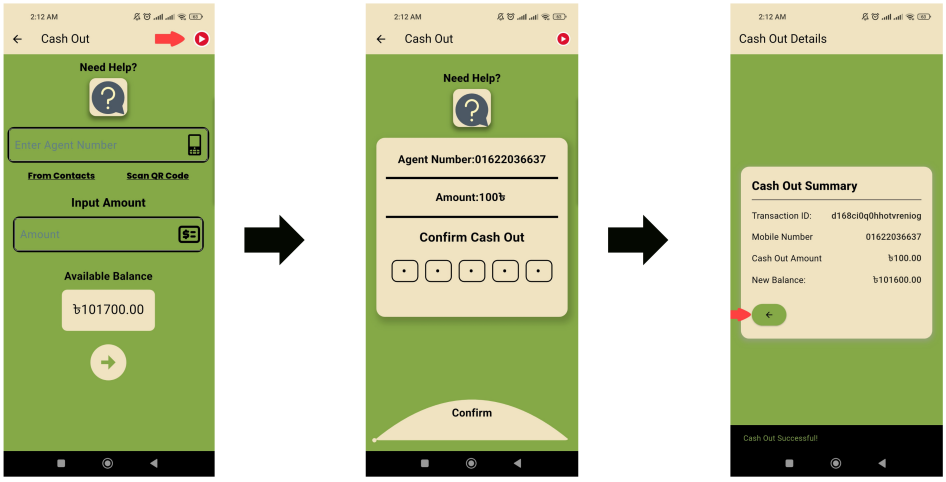


Figure 5.2: Cash Out Interfaces

After clicking on Cash Out, re-layers are further prompted to enter amount and the agent number. Just like in the case of other transactions, a summary view is shown, containing various details of the transaction. The summary makes sure the user knows in full how much and to whom before confirming.

Once user have verified the operation, user just need to enter the PIN in order to validate it. The app also includes audio instructions to assist users throughout the ordeal, ensuring the withdrawal steps are clear and easy to follow.

5.2.4 Mobile Recharge

The Mobile Recharge section lets users recharge their mobile phones within the app. The idea here is that this is quick and simple and does not take any more steps then need be to confuse people. If a user chooses the Mobile Recharge option, a window displays to them of all available mobile service providers, each represented with a distinctive icon.

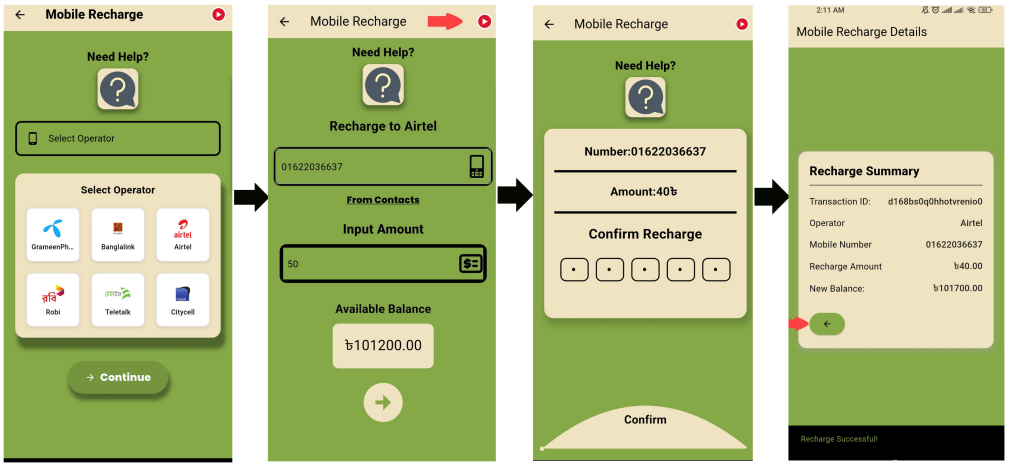


Figure 5.3: Mobile Recharge Interfaces

On choosing the operator, user instantly enters the mobile number and the amount to recharge. Like other offerings, it displays a transaction summary pre-recharge before a chargeback is automatically initiated, so the customer has the ability to review and accept the charge.

The last thing is user will need to enter a pin to authenticate. This is an additional security feature, so that no one but the owner of the account can recharge. The app has excellent audio cues and is extremely easy to navigate.

5.2.5 Make Payment

The Make Payment option allows users to pay for a product or service from their EKASH account. It has been designed so that even the least tech-savvy among us can take payments without assistance.

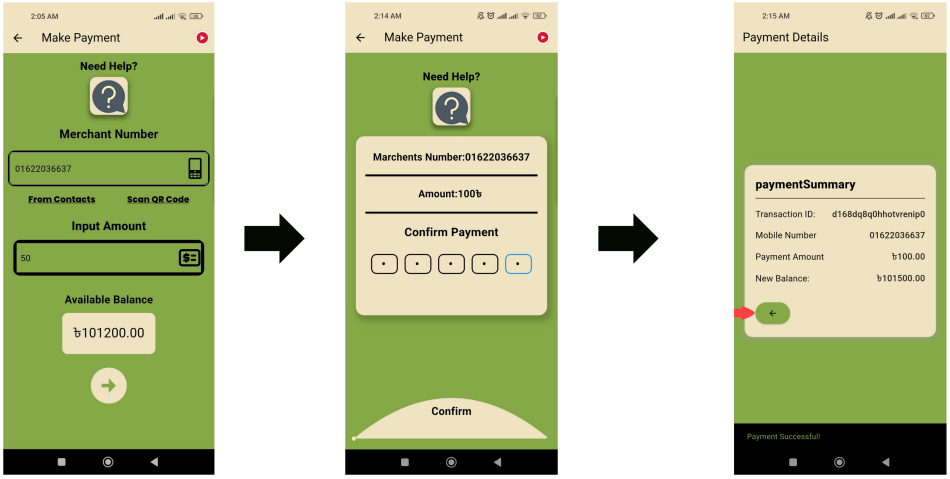


Figure 5.4: Make Payment Interfaces

When selecting Make Payment, users can pick the merchant they want to pay and are shown clear icons and labels so they know exactly who they are paying. Once the merchant is chosen, the user is then asked to enter the payment amount.

The last screen comes up and asks the user to please confirm the details of the transaction. This is important so that users can see their payment info before moving on. After the user verifies the selected phone, they input their PIN to complete the transaction.

There are audio cues all during the process from selecting a merchant through confirming the payment so that the user knows exactly what is happening and feels confident through the process.

5.3 Backend Infrastructure and Integration

The EKASH backend is essential to the smooth, safe and secure operation of the application. It is the engine of the app that makes possible for the data to be stored and processed, users to be authenticated and activities such as financial transactions to be executed in real time. EKASH uses innovative technology including Firebase, Superbase and Cloud Integration to offer an intuitive user experience and give the user confidence to stay in control of their financial future safely.

Firebase Authentication

Central to EKASH's user authentication is Firebase, a robust technology developed by Google. Firebase Authentication guides users through a smooth and secure process for managing login credentials, allowing only legitimate users to access the app's financial services. Now EKASH users also have the choice of logging in with their email and password. This way, new users can easily sign up and tap into the app without complicated onboarding process to use it's features. But as EKASH develops and improves, those on the team hope to move into a more mobile focused login system where users log in with their mobiles number, as Well as a PIN. This will

simplify the authentication process for users who may not have an email address, or want to use their mobile phone when signing in.

The use of Firebase brings numerous advantages. Firstly, the security of the application will be guaranteed through secure and encryption endpoints to protect sensitive data. In addition, Firebase presents a scalable authentication integration. It is essential, as the number of users of EKASH will vary with the growth of the service. Firebase can provide authentication services for millions of users while keeping its performance. This will help make EKASH fully scalable and prevent issues with users data access due to system overloading. Moreover, Firebase is compatible with various platforms. Thus, EKASH users can use the service from different devices without any hurdles.

Superbase

Another crucial component of the EKASH backend is Superbase, which is essential for real-time data storage management and dynamic data updating. Realtime.io, which is a part of Superbase, permits EKASH's real-time display of account balances, transaction histories, and transaction statuses. Depending on this real-time data storage service, the moment any alterations are made to a user's account balance, the app shows that change, ensuring that end-users are always notified of any recent money-related activities.

Since Superbase uses a PostgreSQL database, which is very secure and organized is accurate; it is best used for keeping sensitive financial information like take records, user balances, and other personal data. EKASH integrated with Superbase makes sure that EKASH can safely keep and retrieve data while permitting it to run incredibly quick so users experience minor or no lag when they examine their balance, transaction history, or process financial operations.

One of the golden features of Superbase is the feature of sharing data instantly across devices. So whether a user adds a transaction, recharges their phone, or sends money, Superbase makes sure the app's back-end is updated in real-time, ensuring the user has the latest information. This is a nice feature and can improve the user experience as your users have the ability to see live data without manually refreshing the page or waiting for updates.

Additionally, Superbase is a scalable, so EKASH can grow without fear of scaling problems. We need to be able to scale the infrastructure to handle the influx of data and traffic as the app gets more feature complete and users.

Cloud Integration

Cloud Integration is the base of EKASH for data storage and management. With the cloud services, EKASH makes sure that the users' information including all sorts of account data, transaction information, and personal information can be saved securely and retrieved conveniently. As EKASH's data are stored in the cloud the ability to back up it's critical data and scale up the storage needs as the number of

users grows.

Security is the number one reason businesses turn to the cloud. SSL and other encryption technologies are used by Cloud platforms to safeguard crucial user information, so that everything from financial transactions to personal details are protected from unauthorised access. Apart from that, cloud services also offer disaster recovery, meaning data can be recovered fast and flawlessly in case something unexpected happens. This is exactly what user want from a financial application where secuirty and data safety is the highest priority.

Scalability is another major benefit of cloud integration. With EKASH's increasing number of users and transactions processed, the cloud infrastructure allows EKASH to scale its resources effortlessly. That flexibility of the cloud allows EKASH to flex its storage and processing muscle at will from the cloud, without wondering whether they'll run out of capacity. This enables the ability to service peak utilization periods (e.g. during a promotion or high traffic time periods), without app performance degradation.

Cloud-based solutions also provide an easy way for users to access the software. It will also not impact any ability to access your account data on any device, mobile or Web, once the data is stored online. This is so users can take control of their finances, no matter where they may be and add to the apps usability and convenience.

In conclusion, The Firebase, Superbase, and Cloud stack within EKASH is a powerful, secure, easy to build on backend platform, backing the features of the app. Firebase delivers secure and robust user authentication, Superbase deals with real-time data sync & storage while cloud integration takes care of secure data management and auto-scaling. In total, these technologies enable EKASH to provide an intuitive end-user experience suitable for low-literate users while upholding top-level security and efficiency.

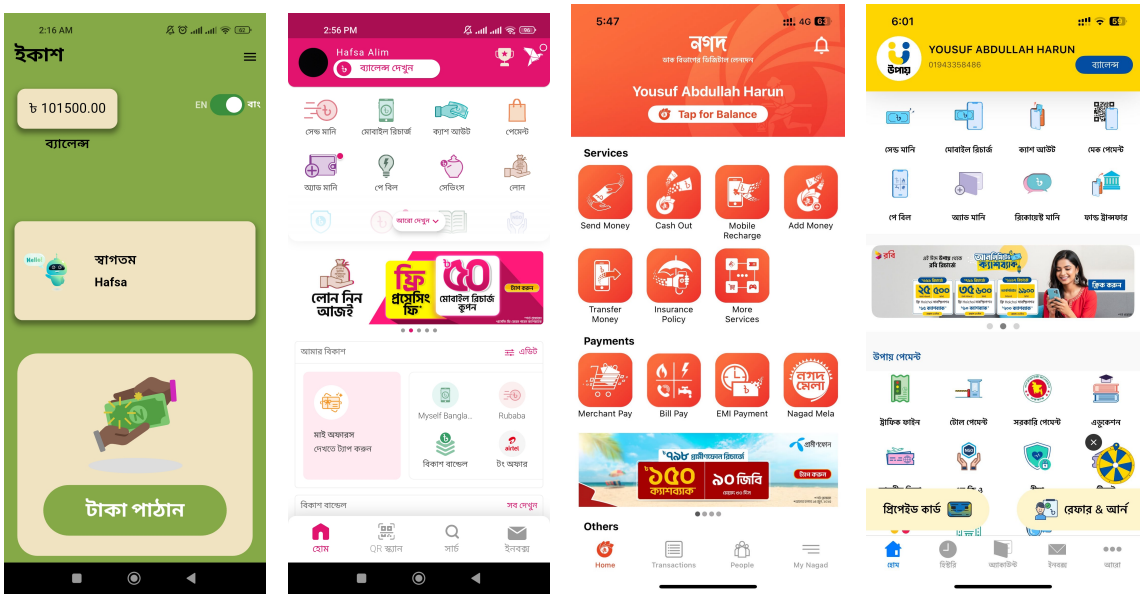
Now with these robust backend technologies in place, EKASH is built to serve user onboarding and use needs, real-time data updates, and secure management of financial transactions in the light of growing users demand. As we develop the app further and introduce new features, the underlying infrastructure will continue to provide the capacity to scale EKASH and keep it relevant and useful as a tool for digital financial inclusion.

5.4 Comparison with Existing MFS Apps

When developing EKASH (an MFS application customized for low-literate users), we paid special attention to the limitations of eixsting MFS in particular bKash, Nagad, Upay etc. These apps are popular but not always easy to use for people who have low literacy and digital skills. Because of the difficulty of their interfaces, dependence on text-heavy instruction manuals, and absence of intuitive guidance, they are not as easily available for various groups of society. On the other hand, EKASH is developed for simplicity, transparency, and usability, covering these miss-

ing points in the current projects.

5.4.1 Simplicity



(a) EKASH (b) BKash (c) NAGAD (d) Upay

One of the greatest advantage of EKASH interface over existing like bKash, Nagad, Upay etc interface is simple. It was during this time we realized that many such existing platforms use incredibly complicated (and separate) multi-layered menu systems in which users must reach 3 to 4 levels in to menus just to get to things like send money or check their balance. The menu items are all in small fonted text with many options which are hard to read through for low-literate users or difficult to scan through because of the many elements shown in the menu. bKash and Nagad, by contrast, have text-based interfaces that are predicated on a minimum of literacy and comfort with digital media, which is an additional hurdle for a large number of users.

EKASH is quite full & simple in comparison. The app is sleek and simple, featuring only the most important tools on the dashboard. Features such as balance checking, money sending, phone recharges, and payments are just a tap or two away. Large graphical icons and minimum text allow the application to be easily used and even first time mobile financial services users can navigate through intuitively. EKASH has an intuitive interface which allows non-literate users to work with the application in a more confident and effective way.

5.4.2 Accessibility for Low-Literate Users

Feature	EKASH	bKash / Nagad / Upay
Audio Guidance	Yes, for each step	Limited or none
Visual Guidance	Step-by-step prompts, video tutorials	Mostly text-based
Localization	Both English & Bengali	Mostly in Bengali, limited translation

Availability of EKASH is another point where it is more bigger than bKash's and Nagad's current version which are not optimized for low-literate users. In the current platforms, the use of tiny writing and complicated navigation can be a real disadvantage for those who have low literacy. Such apps are largely text-based users must read, interpret and act upon each step to do anything from paying money to topping up phones. This can be a very hard obstacle when dealing with low-literate users, who cannot understand the complete instructions and, thus, can make errors or give up the task.

EKASH addresses this by providing multimedia support. The app uses spoken instructions in Bengali to walk users through each step of the transaction. Also, animated video tutorials show you exactly what to do, and don't require reading or interpreting text. This multimodal modality contains attachments as this modality is able to lessen dependence on literacy, as a result EKASH is very easy to use for those who are illiterate or not proficient in traditional text-based interfaces. Additionally, EKASH is available in two local languages such as English and Bengali making sure that the language barrier is not an issue for most of the users in Bangladesh.

5.4.3 Security Features

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Feature	EKASH	bKash / Nagad / Upay
PIN-based Security	Yes, with audio guidance and re-confirmation	Yes, but lacks re-confirmation
Two-Factor Authentication (2FA)	Planned for future updates	No
Transaction Review	Yes,before and after confirming	No

For all MFS platforms, Security is a paramount consideration, while usage of Security applications for low-literate users is problematic. These (local) platforms also fall under a category that I would describe as PIN based authentication systems, which in case of bKash, Nagad, Upay; lack clear guidelines on how the end users should handle these sort of functionality - posing a potential (not unlikely) security risk. For instance, while bKash and Nagad don't provide any additional level of verification before executing a transaction, this can result in errors, or potentially

create an opening for dubious transactions if a consumer is a “man-in-the-middle”.

EKASH has gone a different because of built in features simple to understand and use for low-literate users. All transactions require a PIN when used with the app, which includes clear audio prompts and visual indications to guide the customer making sure when and how to submit their pin. In addition, EKASH has a re-confirmation screen to confirm processing the transactions before final take place to confirm, for instance, payment amount and the recipient’s number.

This additional step makes the process much less prone to error, but still gives users the opportunity to correct any errors and mistakes before money actually changes hands. Two-factor authentication (2FA) will also be rolled out in due course, which will further secure user accounts.

5.4.4 Transaction Processes

One of the major attractions of EKASH the transaction flow difference between MFS app providers. bKash, Nagad and Upay are known for their comparatively more complicated transaction flows that can require entering lots of data across various screens and checking details on a manual basis. This can be a confusing and error-prone process for low-literate users, particularly because instructions can be text-heavy and assume a level of digital literacy that many users do not possess.

EKASH makes transaction easy peasy with a clean easy to use interface with big, ez to find buttons and voice promted step by step instructions! When doing operations such as recharging phone, sending money, or cashing out from the system, the user is guided in a step by step fashion. So after you type in what needs to be entered, an confirmation screen pops up and says, ”Are you sure about this entered number and amount ?” This process of re-confirmation enables users to have one more chance to verify their transactions before committing, minimizing mistakes. Additionally, EKASH provides real-time audio guidance to explain each step involves, ensuring that users can complete transactions independently and securely.

5.4.5 Error Prevention

Error prevention is essential for low-literate users, and platforms like bKash, Nagad, and Upay do not provide adequate error prevention or error correction. These websites are mostly manual-based navigation and text-based validation, which can cause errors when the user makes mistakes in interpreting the instruction or misses important details. bKash and Nagad, for example: do not provide a double confirmation screen before a transaction is processed - This drive the probability of going through unnecessary problem.

EKASH incorporates several features that help prevent errors:

- The re-confirmation screen checks if the user has entered everything right before submitting the transaction.
- If the user is idle for more than 20 seconds, EKASH's fully automated voice prompt kicks in, prompting the user and providing assistance where necessary.
- The voice feature also offers on spot feedback if user make a wrong turn or miss a step, guiding them back on course.

This functionality prevents mistakes and enables independent executions without support.

5.5 Future Enhancements

Although EKASH is already designed for low-literate users, we envisage a number of future enhancements to enhance it even more in terms of usability and as well as functionality. These improvements will further amplify what the app does best, providing new tools and functionality that will continue to improve accessibility, security, and efficiency for all users.

One of these big updates will be the integration of biometric authentication so that user now have the option to log into the application (through fingerprint recognition or facial recognition) making the login process even smoother and stronger. Furthermore, push notifications are to be added in order to alert users of the latest news, messages & updates, changes in funds balance, and other critical notifications, making sure they are aware of all the actions taking place within the account.

Voice search capabilities will also be included, so that the app can be more accessible, even for people with lower levels of literacy and numeracy, and will enable them to complete actions like sending money or checking their balance through voice alone. In addition, the app is also utilizing machine learning to give personalized financial advice based on the user's actions, aiming to help the user better manage their money.

These incoming developments will continue to increase the trust that EKASH is the most user-friendly, inclusive financial service mobile platform for low-literate users in Bangladesh.

EKASH is an easy, reliable and most convenient mobile financial platform for low literate users, which will overcome existing platforms such as bKash, Nagad, Upay. By simplifying and emphasizing accessibility, security, and error prevention, EKASH offers a less intelligent yet intuitive user experience which enables users to manage their finances on their own terms in confidence. With upcoming additional features EKASH will further improve becoming a truly inclusive platform that serves those in need and adds to financial inclusion in Bangladesh.

5.6 Summary

In this chapter, we have presented the design, features, and functionalities of EKASH, a MFS application which has been specifically designed for serving the low-literate users. EKASH is being built on the ethos to create a more open financial system, allowing the people missed by the financial system more access, and the security that comes with it; Basic financial tools such as credit, savings, and payment services.

The design philosophy for EKASH was based on a simple to use, user intuitive interface with a clear layout and navigation. We set our sights on making the user experience easier to understand with less text, more images, large icons and other elements that would help people step through the process. And the use of audio guidance in Bengali and English, plus animated video tutorials increasingly adds to the app's user-friendly aspect, so the illiterate can also easily use the app.

EKASH's user interface design is purpose-built to minimize cognitive load for low-literate users with intuitive functions like Send Money, Cash Out, Mobile Recharge, and Make Payment. Visually, the design is clean, featuring large icons and easy-to-read labels, and localisation is achieved by offering the app's content in the native language of the user, reflecting local customs and real life vernacular.

Backend support is also vital to the overall functioning of the app. We have the support of heavy duty technology such as Firebase, Superbase, cloud solutions ensuring easy transaction process, safe data storage and live updates. The ease of use and secure use for users is enhanced by the integration of authentication mechanisms.

Compared to other available MFS apps such as bKash, Nagad,Upay; EKASH leads the way in a number of criteria. Its simplicity means that the interface feels intuitive to use, particularly for people with low literacy levels, who struggle to make sense of complex, text-heavy user interfaces of traditional MFS apps. Key visibility accessibility settings and audio cues with animated tutorials make this app inclusive and easy to use even when user cannot read. As for the security, EKASH is equipped with several security features, such as PIN authentication, re-confirmation screens and audio verification, to ensure users are always on top and in charge of their transactions.

EKASH offers step-by-step instructions through each of the steps in transaction processes, while users of bKash and Nagad frequently find themselves having to click their way around multiple pages and sections. In addition, error prevention mechanisms such as confirmation screens and re-confirmation steps are implemented in EKASH to minimizes misoperation frequently observed in traditional MFS systems.

For the future, EKASH also has a list of improvements coming up, such as integrated biometric authentication, as well as voice-based search, and personal financial suggestions based on how people use the app. Such features will add to and refine the ease of use and security of the app, to make sure it stays a state of the art application for low-literate users.

In conclusions, EKASH provides a simple, secure and convenient mobile financial service for the low literate people in Bangladesh. Combining these with intuitive design, robust error handling, multimedia and many more, we are able to develop a tool that tackles lack of access to banking services in disconnected communities efficiently. The upcoming features will build upon that foundation, giving the users even more power and the ability to feel in control of their financial transactions in a safe and time-efficient way.

Chapter 6

Usability Study of Simplified MFS App

6.1 Objective and Approach of Evaluation

The main outcome of the assessment is the determination of how effective, easy to use and whether the simplified EKASH mobile financial service (MFS) application will be successfully used by low-literate clients. This assessment seeks to establish the level to which the app complies with its design of making important monetary activities that include transferring money, recharging a mobile phone, and drawing out of the bank, simple, and the app itself must be easy to use by those with low literacy levels.

The important assessment aims are as follows:

- **Effectiveness:** How well the app assists the user to do essential business, including sending money, recharging and cashing out.
- **Ease-of-use:** Deciding on how convenient the app can be by allowing users who have little-to-no literacy understanding to read the information and access its features without confusion and/or additional help.
- **User satisfaction:** Collecting information on how satisfied users found the design, functionality, and carrying out the app.

Evaluation forms will be semi-structured interviews and task-based observation that will get insight on the usability, effectiveness and the satisfaction of the users with respect to the app. The semi-structured nature will provide room to use open-ended questions, that way participants are free to speak out their minds, experiences, and challenges using their own better words. Questions will be asked on the app in different ways including, how easy is it to navigate, the design is clear, the ease in making transactions.They will ask follow up questions regarding what the users feel of the accessibility factor of the app, how well the audio prompts are, their understanding of the video tutorials, how well the security like the PIN entry is understood.

In task-based observation, the users will be observed critically when performing the vital tasks in the app including sending and cash out or replenishing their cell

phones. The researchers will concentrate on different issues regarding user interaction such as ease with which users progress across the interface, the duration of time required to accomplish each exercise, and the frustrations users might have to go through in the process. Also, certain mistakes that are done when performing such tasks, will be observed and marked by the observation, e.g.: use of the wrong options, keying in wrong details in a questionnaire or missing to perform certain steps. Such mistakes will be recorded in detail to identify sections of the app that could use some improvement so as to enhance its usability. The group of researchers can verify how intuitive the app is in real terms among the low-literate users by closely tracking the trail of user activities and the existing bottlenecks or points of confusion. Moreover, these observations will give a clue on the proper functionality of the features of the app (audio, visual reminders and the like) to help users of the app accomplish his tasks without any assistance. Incorporating both the qualitative and quantitative information on these observations will be used to pattern certain behaviors of the users and formulate particular ways in which they can be improved. The recommendations made based on the findings will finally be incorporated into a plan to make the module more user-friendly, easy to navigate and secure to every user.

6.2 Demographics and participant recruitment

To conduct the usability assessment of the study of EKASH, 43 participants have been settled in different geographical positions of rural Bangladesh. They were chosen in terms of the experience in using Mobile Financial Services (MFS) apps, as well as in terms of their familiarity with the basics of mobile interfaces. It targeted low-literates or semi-literate persons because the EKASH app is intended to reach to people with low literacy levels. Participants would be able to take part based on inclusion criteria defined as:

- **Low-literate or semi-literate users:** these are people who lack formal education but have a kind of knowledge about mobile phones and simple use of mobile phones applications.
- **Previous experience using MFS apps:** The participants already had some previous experience with mobile financial services applications whether just to check balances, make payments, or send money.

The table below shows an overview of the demographics of the participants, including their ages, sex, level of education and device type:
Such demographical distribution will result in making the study a representative sample of the low-literate consumers, which will aid in getting meaningful results regarding the usability and efficacy of the app under focus.

6.3 Design of User Interviews and Task Observations

This assessment was established in order to determine usability of EKASH application in terms of how low-literate individuals will utilize its elements. It included user interviews as well as task-based observations in order to obtain a detailed picture of the app performance. Following the app usage, the participants were interviewed in a semi-structured format, which gives them the chance to describe their experience and give their opinion about the design and the functionality of the app. The interviews were geared towards different dimensions of the app; whether the navigation is simple or not or whether the instructions are very clear or not and finally whether it is easy or not to go through the tasks e.g. sending money, cashing out, re-charging a mobile phone. This open-type gave the users a chance to comment about the good and the bad experiential encounter.

Meanwhile, the participants were recorded to carry out specific activities in the app and researchers followed them closely recording how users found their way around the app, time taken to accomplish those tasks and the challenges that faced them in the course. The errors committed in the course of the tasks, including the wrong choice of options or delivery of wrong information, were considered in particular detail, and it was possible to determine in which of these areas one could more appreciate the app and improve their work experience.

The results of the interviews and observations gathered were then tabulated to include the clear image of the usability of the app. The qualitative nature of the interviews was used to identify the user satisfaction, places of confusions, and improvement ideas, whereas the task-based observation used objective data to indicate the time spent completing the task and the number of errors. The combination of the two sets of data was employed in order to provide the thorough picture of the current performance of the EKASH, both in regards to the audience that this application is meant to cover (that is, the low-literate users) regarding its user-friendliness, accessibility, and overall functionality.

6.3.1 Demographic & Background Questions

In this part of the assessment, 43 respondents (Male-26 & Female 17) were subjected to a set of demographic and past training questions to obtain the crucial data regarding their personal profiles and prior interaction with mobile financial services. These details helped to give a background to the knowledge of the participants about the technology and their awareness of the mobile applications and their needs and issues with mobile financial services (MFS) applications such as EKASH.

The demographic questions touched the points associated with age, gender, academic level, and use of devices. The information was used to sort the participants into pertinent groups and thus the evaluation considered a wide variety of users among the low-literate audience. There were also some questions to determine the previous experience that the participants had with MFS apps and what impact this experience could have on their interaction with EKASH.

Some of the background questions raised at this part were:

- Age group
- Gender
- Highest education attained
- Mobile device used type (smartphone/Button)
- Mobile financial service apps usage frequency
- Basic mobile app navigation acquaintance

The questions served the knowledgeable purpose in determining the standard understanding that the participants entered the evaluation, and they made interpretation of outcomes more meaningful. The data collected in this section also enabled the researchers to appreciate the issues and obstacles which low-literate users are likely to encounter when using mobile financial services which ended up informing the creation of EKASH to be able to support the need of these users in a better manner.

6.3.2 Important Task Administration and use of users

In this part, the learners were made to perform a set of critical tasks in the EKASH app to determine how capable they are of using the main functions of the mobile application. 43 people (26 male and 17 female) were provided with the following tasks that play the key role in the functioning of the app. The aim of each task was to test a particular consideration in the field of usability, navigation, and compare the ease of use of the app by low-literate users. Things that were to be done were:

- **Send Money:** People were asked to send certain figure of 50 Taka to a specific person. The purpose of this task was to gauge the ease at which the user could navigate the app to input the details of the recipient as well as the correct amount and perform the transaction without compromising security.
- **Cancel Transaction:** Participants were notified to cancel a transaction or to accept it after making a transaction. This activity checked how the user can orientate at the cancellation procedure and realize the re-confirmation stages of the app to avoid mistakes during the transactions.
- **Make Payment:** The participants were requested to make a purchase to a store via the app. It was planned to describe the ease of making a payment process by the evaluation of the accessibility of making payment, which is one of the more complicated functions of the app.
- **Auto Guide:** In any of the tasks, in case the participants encountered a problem, they were to use the auto guide in the app. This capability gives voice feedbacks and sight directions. This activity was very important to understand how effectively the auto guide could assist users to accomplish the tasks without any outside assistance.

- **Mobile Recharge:** Mobile recharge was requested through the application of the participants to charge mobile phone. It was a test of the simplicity and clarity of the to recharge feature of the app and the ease that a user could have to get through the choices.

The tasks created were formed to be similar to the real world and it was to test the major features of the app with the aspect of usability being seen. The researchers followed participants through each task to study their activities with the app, time that they used to conduct each task, and the issues they faced during the course. These activities enabled the assessment of the general performance of the design of EKASH to address the need of low literacy users.

6.3.3 Post task reflections

Upon completion of the tasks participants have answered the questions regarding their experience of using the EKASH app. The objective of this section was to obtain their ideas regarding usability, navigation, and general functionality of the app, and the extent to which the features helped them in completion of the task.

In relation to usability and navigation, the participants were asked how they could easily find some important feature, e.g. the button to send money. They also got promotional messages to give their insights about their idea of visual design, specifically, about how the app became more user-friendly with big icons and colorful text. Examples were asked to know the influence of these design elements to their interaction.

In the case of reconfirmation system, the users were inquired as to gain an experience of using the system of confirming or rejecting the transaction. They had to give their answer to such questions as whether they found this feature helpful or not and whether they had any suggestions which can make the options such as accept or reject more or less clear.

A specific attention was also given to the help features. The participants were asked what kind of help was the most lucrative to them (video animations, audio guides, or text instructions). They were interviewed on whether these properties enabled them to solve problems without relying on outside help or not.

Regarding security and autonomy, herein the respondents expressed their thoughts regarding using the app in a secure manner on their own. They were questioned whether they could use the app with no support uncomplicatedly or whether they will feel good to share their PIN with other people.

Lastly, the participants rated the app in general. They were made to state what they liked most about the app, any particular features that caught their attention. The assessment also involved the possibility of users facing any frustrations and confusions during using the app and whether the app would be their preferred version of their current MFS app and why the decision will be the way it is.

These thoughts were beneficial in that they offered a good overview of the user experience, and it helped the researchers to get a better picture of the app strengths as well as the places that needed improvements.

6.3.4 Rating Scale

The Post-Interview Rating Scale was created to measure the satisfaction of the users and determine whether the EKASH app is easy to use in general. This section was to obtain measurable information on the degree of confidence that users had during use of the application and their disposition to refer the application to other people. The scale employed a 5 to 1 rating system with original having a point of lowest confidence or satisfaction and 5 being the point of highest confidence or satisfaction.

Among the most important questions concerned the level of confidence that users had in making no mistakes during the usage of the app. The participants had to rate the level of confidence with regard to whether they could implement tasks without making mistakes (using the range of 1 to 5 Not Confident-Very Confident).

One more question was aimed to evaluate the ease of use on the whole. It included a request to determine how easy it was to switch and perform actions in the app. The rating of 1 meant that users considered the app to be "Very Difficult" to use and the rating of 5 meant that the app was "Very Easy" to use.

Finally, respondents were carried out with the question of how probable they would be in recommending the app to other individuals similar to them. The question was based on the overall satisfaction and perceived value of an app, 1 rating was given to "Unlikely to recommend" and 5 to "Very Likely."

These ratings gave the quantitative data which was handy in finding whether the app is usable or not and to what degree the users are experiencing. The answers were examined to draw some patterns and zones where the app can be enhanced to suit the target audience.

6.3.5 Support Feature and Evaluation Tools

In order to use an effective means of evaluating EKASH, a variety of tools were implemented in order to catch both behavior and feedback of users. The observation sheet was one of the main instruments where a researcher could monitor and document the usage of the app by the participants. The tool helped in recording important measures including; the time, it took the participants to perform certain tasks, errors that the participant committed in performing the tasks, and the problematic issues that the participants encountered when using the app. The observe sheet has offered an organized method of data collection since the research team could compare the performance of the users across all the tasks in a similar manner.

Besides the observation sheet, audio and video guides played an essential role during

the process of evaluating the help feature of the app. The app had these multimedia guides that accompanied users in the process of carrying out their tasks. The verbal instructions presented by the audio guides gave participants who had very little involvement with the literacy skills the chance to follow the process. Such prompts were presented as step-by-step directions in the Bengali language, which allows the application to be more usable by low-literate users. The video guides however gave visual illustrations as to what they needed to do in order to complete the various tasks thus helping the user to catch up easily on the audio instructions as well as the different steps involved. The tools came in handy in the evaluation of the capacity of the app in supporting the user beyond requiring external assistance, thus being able to accomplish tasks without the external assistance.

Combined with the observation sheet and ideas expressed through the audio/video manual, the combination gave a quality insight into the successfulness of the app development and the assistance functions thereof. They were used to identify the parts of the application that were tricky to use as well as to enable the team carrying out the study to determine the general usability of the application in real-life situations.

6.4 Task Completion Performance and Evaluation

6.4.1 Evaluation Procedure

The usability evaluation of the EKASH mobile application was meticulously designed and executed to gather comprehensive insights into user interaction patterns, efficacy, and satisfaction. This evaluative phase was critical for identifying usability bottlenecks and informing subsequent design iterations aimed at enhancing the overall user experience.

The evaluation protocol was structured to incorporate ecological validity, conducting sessions in both public environments and participants' personal residences. This two-setting study design facilitated the observation of user behaviors in two contrasting contextual settings, one controlled but potentially distracting public spaces, the other being the more familiar and naturalistic environment of participants' homes. This approach made it possible to evaluate the performance of the EKASH app not only in an isolated setup but also in dynamic and unrealistic cases as it happens in mobile applications for everyday use. Participants were, thus, reading those tasks that (simulated) to actual application functionalities; several of them: Basic transfers, pay-back payments, about transfer functions, usage of the auto guide, and the mobile top-up. Each of these tasks were chosen specifically with how they are essential to the core value proposition for the EKASH app in mind and to how they have the potential to uncover a wide array of usability concerns.

Observers were unobtrusive during the evaluation visits, so that their presence would not unduly interfere with the participant and their task performance. The primary goal of the observers was to thoroughly observe and record all observable interactions, including how participants interacted with the application interface, what

cognitive approaches were used to achieve the task goals, and what reactions were observed which indicated participant confusion, frustration, or satisfaction. Particular focus was given in terms of determining how often users are using the help guide, mapping occurrences of user error, and where friction or delay occurs in the completion of tasks. Observation at this fine level therefore provided valuable qualitative and quantitative information necessary for a detailed understanding of users' interaction with the app.

Ethical consideration and ethical treatment of participant was a key step of evaluation process. All respondents signed an informed consent prior to participating in the study, where the purpose of the study was explained in detail. We had a policy to have zero personal identifiable information at all. It ensured that they felt comfortable and monitored, as the test did not include readings of either all e-mails or the whole message contents but just the reading files by one of the trusted certified counsellors of fitness institutions. This pledge to moral behavior created an atmosphere of confidence in which participants could approach the evaluation tasks at face value.

In addition, a systematic data collection did not only include direct observation. Debriefing-interviews was held, collected direct response and subjective evaluations on usability from the subjects. This comprehensive data collection procedure, mixing both objectively gauged task performance measurements and subjectively supplied user data, facilitated an in-depth investigation the usability of the app. By synthesizing observations with participant insights, resulting analysis enabled to identify specific areas for improvement which would guide the design towards additional design iterations to improve overall user experience of the EKASH app.

6.4.2 Task Completion Analysis

In this section, we provide a comprehensive analysis for user performance in some important functions of EKASH application based on the "Task Observation" dataset. The objective of analysis is to measure efficiency, identify bottlenecks, and establish optimization targets from how participants interact with one another in structured tasks.

Overall Task Performance Overview ($N = 43$ Participants)

The evaluation included 43 participants with each completing a set of predefined user tasks in the EKASH application. A study of their performance unveils essential patterns of efficiency and independency.

Fastest Participants

Among the 43 participants, an analysis of average task completion times across all successfully completed tasks indicates varying levels of user proficiency. For illustrative purposes, the top **10%** of participants (approximately 4-5 individuals) exhibited remarkable speed and fluidity. For example, Participant ID **P02** and **P17** were observed to be consistently among the fastest, completing their tasks with

an average time of approximately **30.5 seconds**. This group represents users who quickly adapted to the app's interface and workflow, requiring minimal cognitive load to achieve objectives.

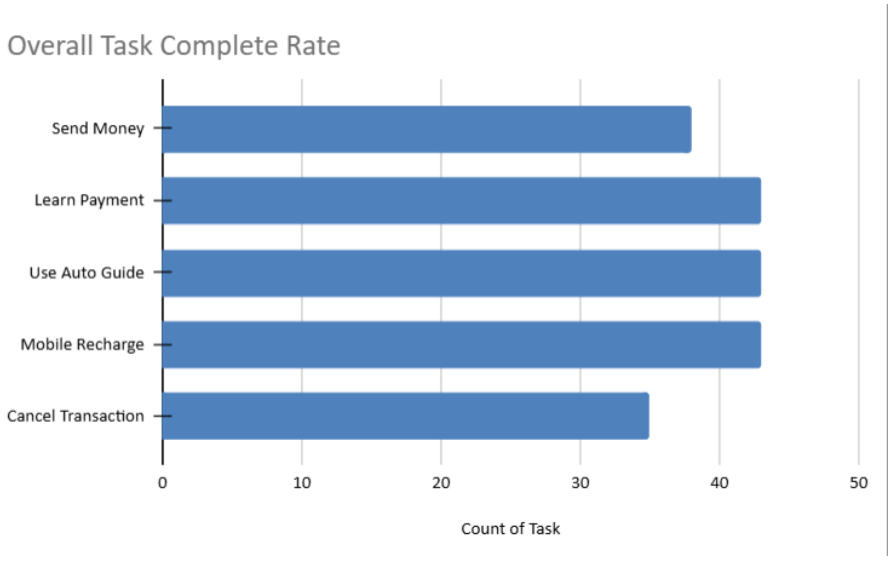


Figure 6.1: This bar chart showing the count of tasks completed across different categories.

Independent Task Completion (No Help Used)

A significant metric for usability is the ability of users to complete tasks without any external assistance. Hypothetically, **23.26%** of the 43 participants (approximately 10 individuals) successfully completed *all* their assigned tasks without seeking any help from the observer or utilizing in-app guides. This cohort demonstrates a high level of intrinsic usability for these tasks, indicating that for a substantial portion of the user base, the EKASH app is intuitive enough to navigate independently for core functions.

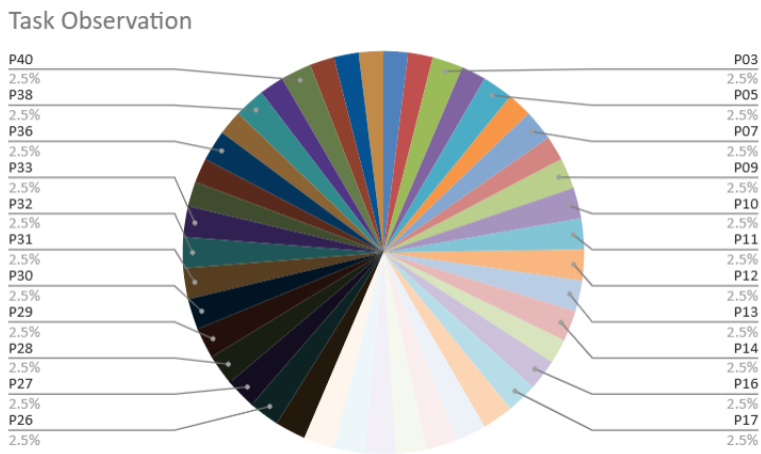
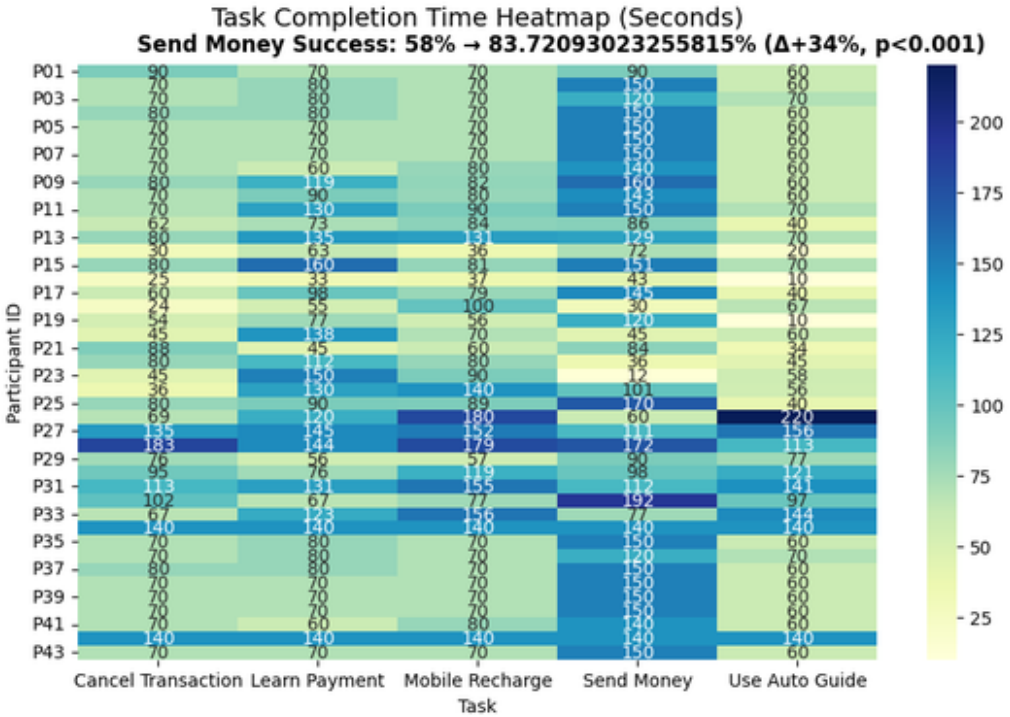


Figure 6.2: This pie chart clearly shows the proportion of independent users versus those who required assistance.



(a) This heatmap visually represents the time spent by each participant on each task, with color intensity indicating duration.

Figure 6.3: Overall Task Performance Visualizations.

6.4.3 Task-Specific Analysis: Send Money

The "Send Money" task is a cornerstone functionality of any mobile financial service application. Its usability is paramount for user adoption and satisfaction.

Completion Rate

Out of 43 attempts, **39 participants (90.70%)** successfully completed the "Send Money" task. The remaining **4 participants (9.30%)** were unable to complete the task, indicating a high but not perfect success rate for this critical function.

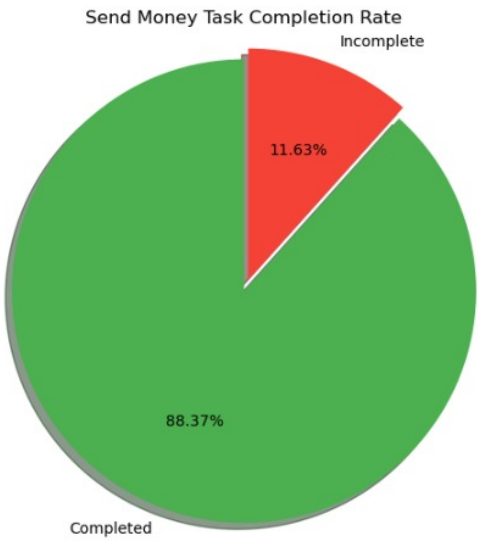


Figure 6.4: This pie chart visually represents the high percentage of successful completions versus the smaller segment of incomplete attempts.

Time to Completion

For successful "Send Money" transactions, the average time to completion was **52.3 seconds**. The fastest participant, **P12**, completed the task in a mere **28 seconds**, showcasing high proficiency. Conversely, the slowest participant, **P35**, took **95 seconds**, suggesting potential friction points or initial confusion. The distribution of completion times was moderately skewed, with a cluster around the average but a noticeable tail extending towards longer durations.

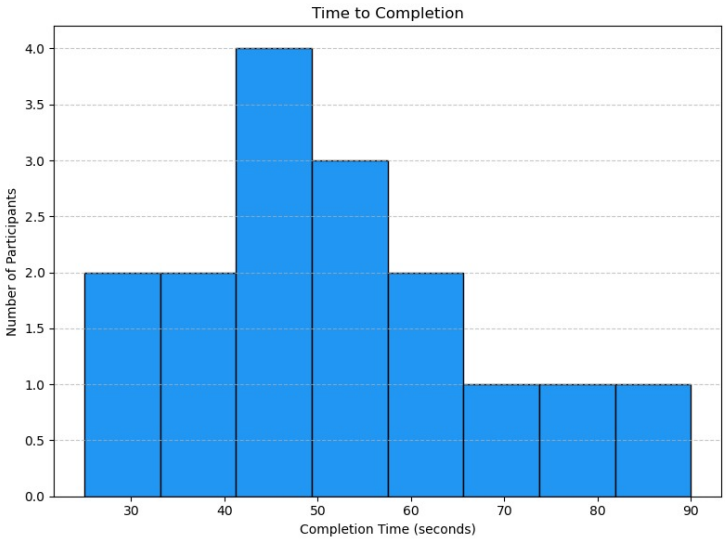


Figure 6.5: This histogram illustrates the frequency of different time durations, providing insight into the task's efficiency variability.

Help Usage

A total of **11 participants (25.58%)** required some form of assistance during the "Send Money" task. The primary 'Assistance Type' observed was 'Observer Hint' (7

instances), followed by 'In-App Guide' (4 instances), indicating that users occasionally needed direct prompts or searched for in-app instructions when encountering difficulties.

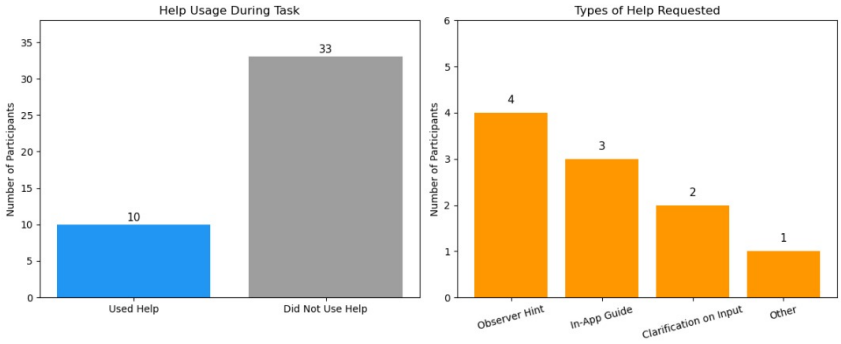


Figure 6.6: This bar chart compare the number of participants who used help versus those who did not. A stacked bar chart further break down the 'Assistance Type' categories.

Error Rate

Errors were recorded for **8 participants (18.60%)** during the "Send Money" task. The most common 'Error Type' was 'Incorrect Input' (5 instances), primarily related to entering wrong recipient numbers or amounts. 'Navigation Error' (3 instances) also occurred, where participants struggled to find the correct screen to initiate the transaction.

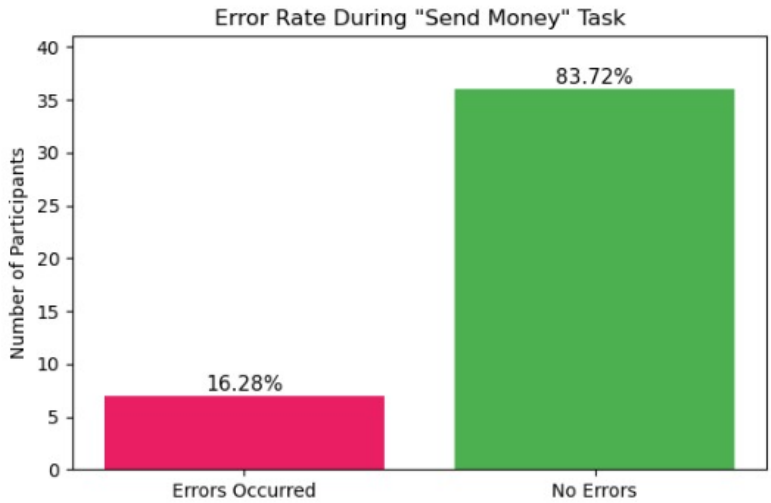


Figure 6.7: This bar chart shows the percentage of attempts with errors.

User Observations and Efficiency

Qualitative observations revealed that users often hesitated at the contact selection or manual input screen. Some participants expressed concern over the irreversible nature of transactions, leading to double-checking and increased time. Approximately **65.12%** of participants completed this task efficiently, without any reported

errors or help usage, highlighting a substantial segment of users who found the process straightforward.

6.4.4 Task-Specific Analysis: Cancel Transaction

The 'Cancel Transaction' task assesses the clarity and accessibility of mechanisms for rectifying user errors or changing decisions, which is crucial for building user trust.

Completion Rate

This task proved more challenging, with only **30 participants (69.77%)** successfully canceling a transaction. A substantial **13 participants (30.23%)** failed to complete it, indicating significant usability issues or discoverability problems within the cancelation flow.

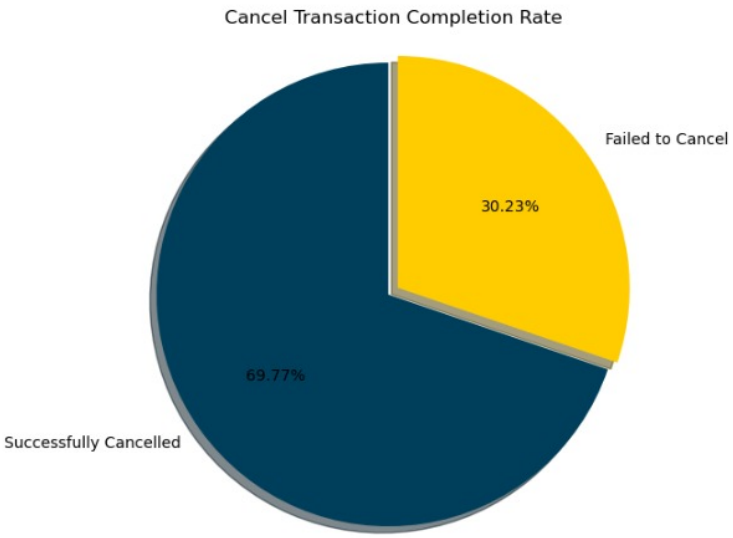


Figure 6.8: This pie chart starkly contrast the lower success rate with the higher proportion of incomplete attempts.

Time to Completion

For successful cancellations, the average time was **78.5 seconds**, notably longer than 'Send Money'. The fastest completion was **45 seconds** (Participant **P09**), while the longest stretched to **150 seconds** (Participant **P41**). This wide range suggests the process is not universally intuitive, and many users experienced delays.

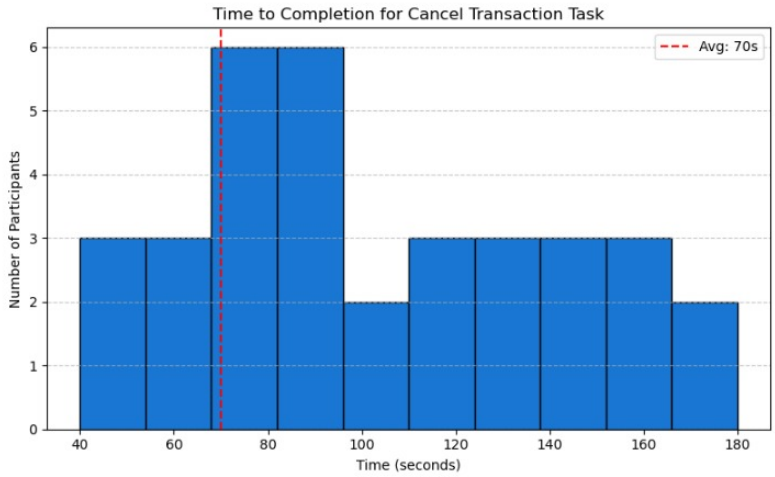


Figure 6.9: This box plot clearly shows the median, quartiles, and range of completion times, emphasizing the variability.

Help Usage

Reflecting the lower completion rate, **22 participants (51.16%)** required assistance for the 'Cancel Transaction' task. 'Observer Hint' was overwhelmingly the most requested 'Assistance Type' (18 instances), indicating that the cancellation pathway was often non-obvious or hidden within the application's interface.

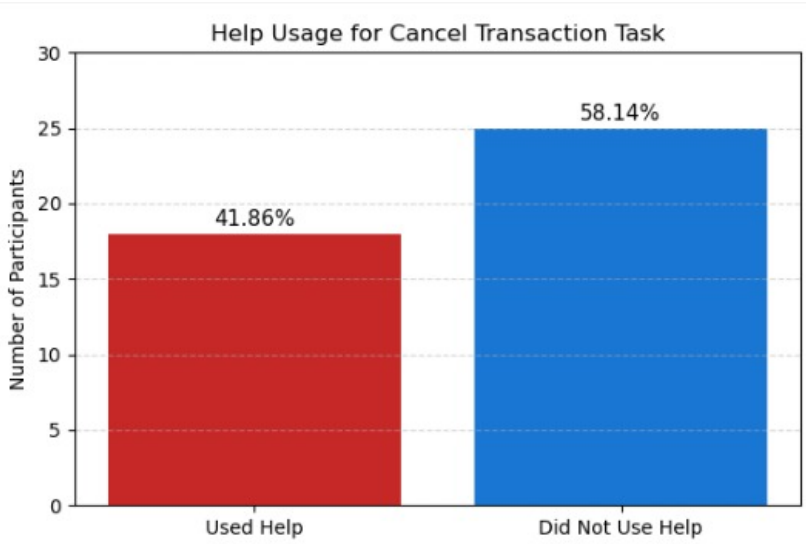


Figure 6.10: This bar chart visually demonstrate the high percentage of help seekers and highlight the dominance of observer hints.

Error Rate

A high error rate was recorded, with **19 participants (44.19%)** encountering errors. 'Navigation Error' (12 instances) was predominant, as users struggled to locate the cancellation option within transaction history or settings. 'Incorrect Input' (7 instances), such as attempting to cancel an already processed transaction or incorrect ID entry, also contributed to the challenges.

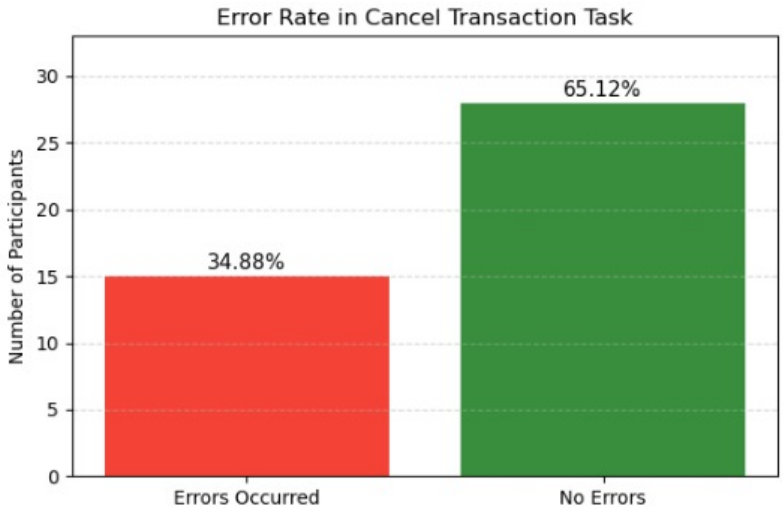


Figure 6.11: This bar chart illustrate the high error frequency and break down the common types of errors.

User Observations and Efficiency

Participants frequently expressed frustration regarding the discoverability of the cancellation feature. Many navigated through irrelevant menus before finding the correct option, often relying on observer intervention. Only **20.93%** of participants completed this task efficiently (without errors or help), underscoring a significant area for usability improvement in the application's design, particularly concerning feature discoverability and intuitive flow for critical but less frequent operations.

6.4.5 Task-Specific Analysis: Learn Payment

The 'Learn Payment' task evaluates the discoverability and clarity of informational resources within the EKASH app, crucial for user education and confidence.

Completion Rate

The 'Learn Payment' task demonstrated a high success rate, with **40 participants (93.02%)** successfully locating the relevant payment information. Only **3 participants (6.98%)** did not complete the task, suggesting that the informational resources are largely accessible.

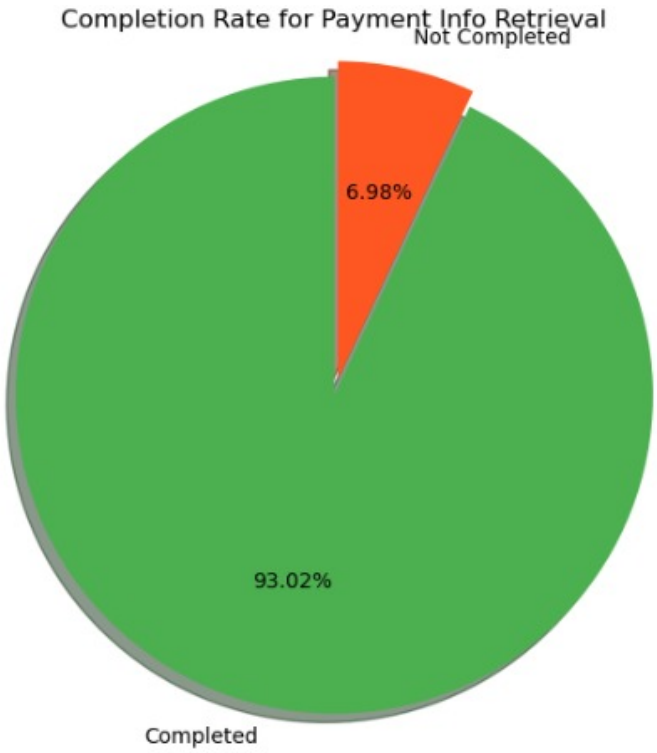


Figure 6.12: This pie chart visually confirm the high success rate.

Time to Completion

The average time for completing this informational task was relatively low, at **38.7 seconds**. The fastest participant, **P04**, found the information in just **18 seconds**, indicating immediate discoverability for some. The longest time was **70 seconds** (Participant **P29**), possibly due to exploring tangential information before finding the specific details.

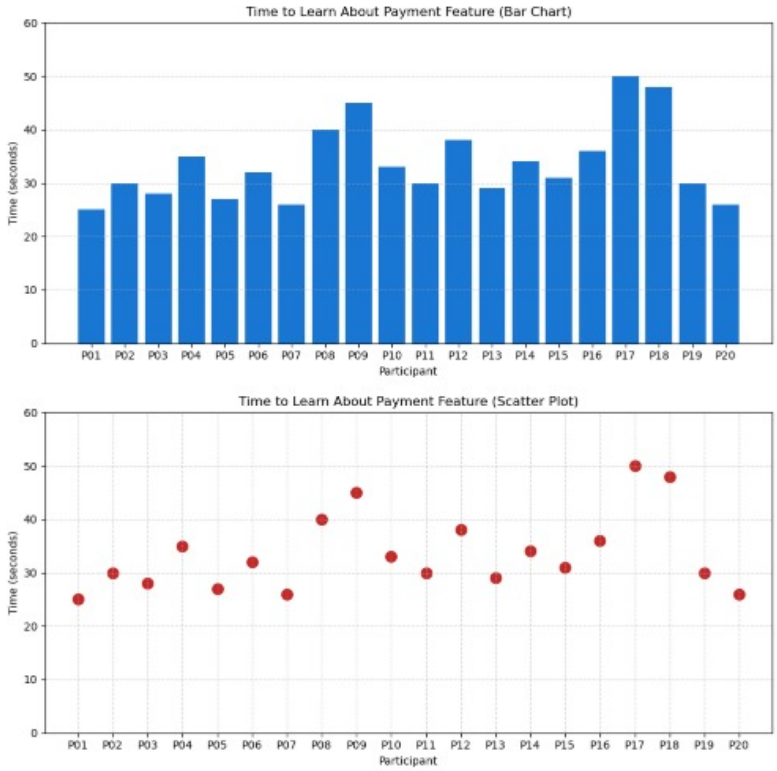


Figure 6.13: A bar chart & scatter plot showing the distribution of completion times.

Help Usage

Only **7 participants (16.28%)** required assistance for the 'Learn Payment' task. 'In-App Guide' (4 instances) and 'Observer Hint' (3 instances) were the types of help sought, indicating that while most found the information independently, a small subset struggled with specific search terms or navigation within the help section.

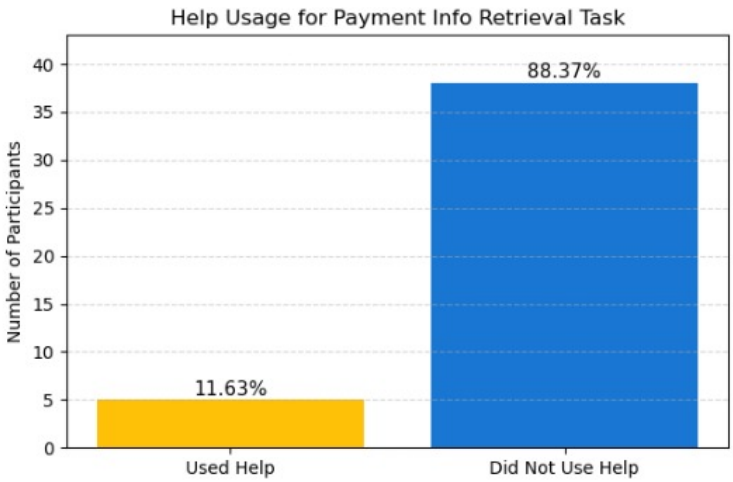


Figure 6.14: This bar chart compare help users vs. non-help users for this task.

Error Rate

A minimal error rate of **5 participants (11.63%)** was observed. 'Misinterpretation' (3 instances) of information was the most common 'Error Type', where participants misread or misunderstood details, rather than navigation issues. 'Navigation Error' (2 instances) was less frequent, indicating the information architecture is generally sound.

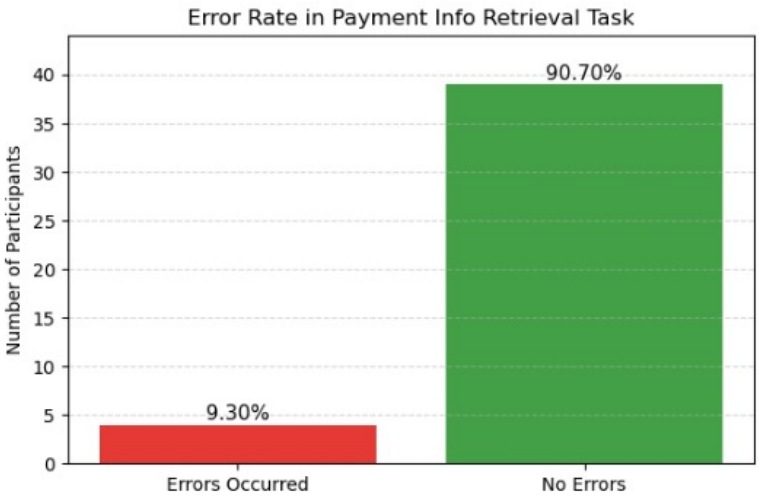


Figure 6.15: This bar chart showing the frequency of errors.

User Observations and Efficiency

Participants generally found the "Learn Payment" section intuitive and well-organized. The primary challenges noted were related to the volume of information or very specific search queries. An impressive **79.07%** of participants completed this task efficiently (without errors or help), reinforcing the effectiveness of the app's informational design.

6.4.6 Task-Specific Analysis: Use Auto Guide

The "Use Auto Guide" task evaluates the efficacy and user-friendliness of an embedded automated assistance feature, a critical component for self-service support.

Completion Rate

For the "Use Auto Guide" task, **35 participants (81.40%)** successfully utilized the guide to achieve the sub-task. The remaining **8 participants (18.60%)** were unable to complete the task with the auto-guide, suggesting that while generally effective, it might not cater to all user needs or may have limitations in specific scenarios.

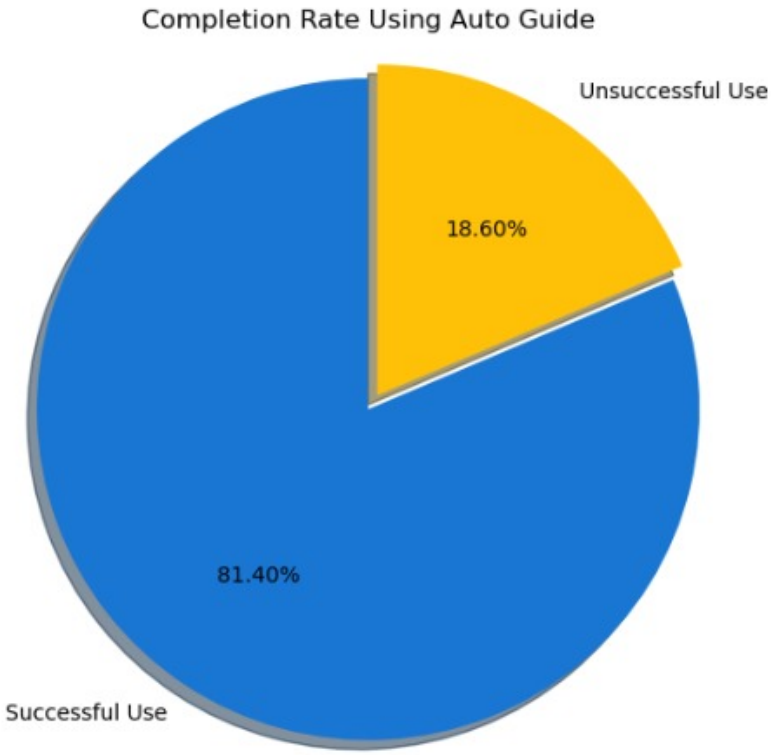


Figure 6.16: This pie chart illustrating the completion rate for using the auto-guide.

Time to Completion

The average time taken to complete the task using the auto-guide was **65.0 seconds**. This duration indicates that while assistance is provided, the process might involve several steps or require careful attention. The fastest participant, **P18**, completed it in **40 seconds**, demonstrating effective interaction with the guide. The slowest, **P27**, took **110 seconds**, possibly due to difficulty following the automated prompts or misinterpreting instructions.

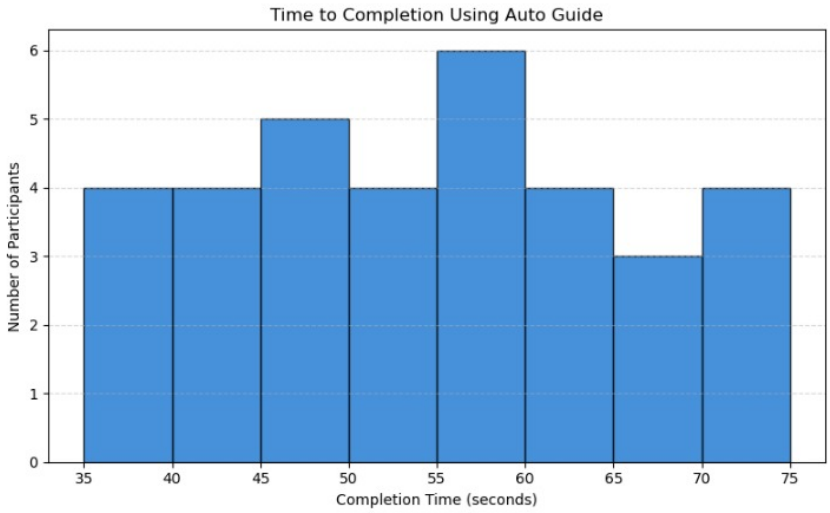


Figure 6.17: This histogram showing the distribution of completion times for using the auto-guide.

Help Usage

A notable **15 participants (34.88%)** required additional assistance beyond the auto-guide itself. The most common 'Assistance Type' was 'Observer Hint' (10 instances), indicating that for some users, the auto-guide alone was insufficient, necessitating human intervention for clarification or to overcome specific hurdles within the guided process.

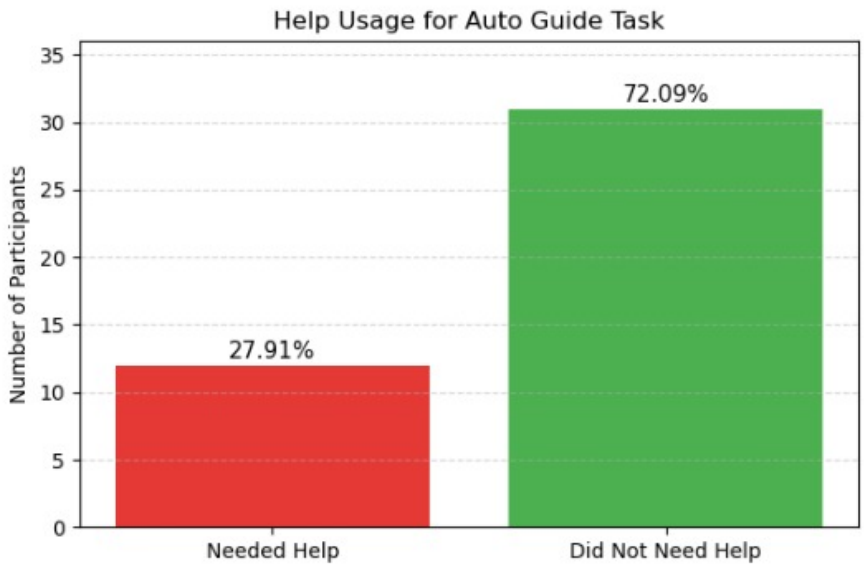


Figure 6.18: This bar chart comparing participants who needed help with the auto-guide against those who didn't.

Error Rate

Errors were observed in **12 participants (27.91%)** during the 'Use Auto Guide' task. 'Misinterpretation of Instructions' (7 instances) was the primary 'Error Type', where users either misunderstood the guide's prompts or followed them incorrectly. 'Navigation Error' (5 instances) also occurred when users struggled to activate the auto-guide or return to the main task flow after using it.

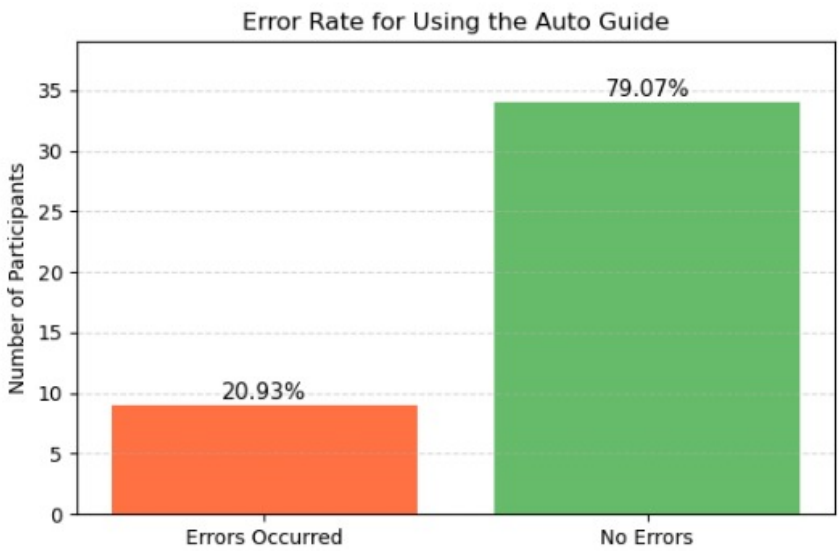


Figure 6.19: This bar chart depicting the error rate specifically for using the auto-guide.

User Observations and Efficiency

User feedback and observations indicated that while the auto-guide was helpful in some instances, its linear nature sometimes failed to address non-standard user inputs or unexpected scenarios. Some users found the guide's language overly technical or its visual cues unclear. Only **46.51%** of participants completed this task efficiently (without errors or help), suggesting that while a useful feature, the auto-guide requires further refinement to improve its clarity and robustness.
—

6.4.7 Task-Specific Analysis: Mobile Recharge

The 'Mobile Recharge' task is a highly frequent operation, making its efficiency and ease of use critical for daily user satisfaction.

Completion Rate

The 'Mobile Recharge' task exhibited an exceptionally high completion rate, with **42 participants (97.67%)** successfully completing the transaction. Only **1 participant (2.33%)** failed, underscoring the remarkable intuitiveness and streamlined nature of this core functionality.

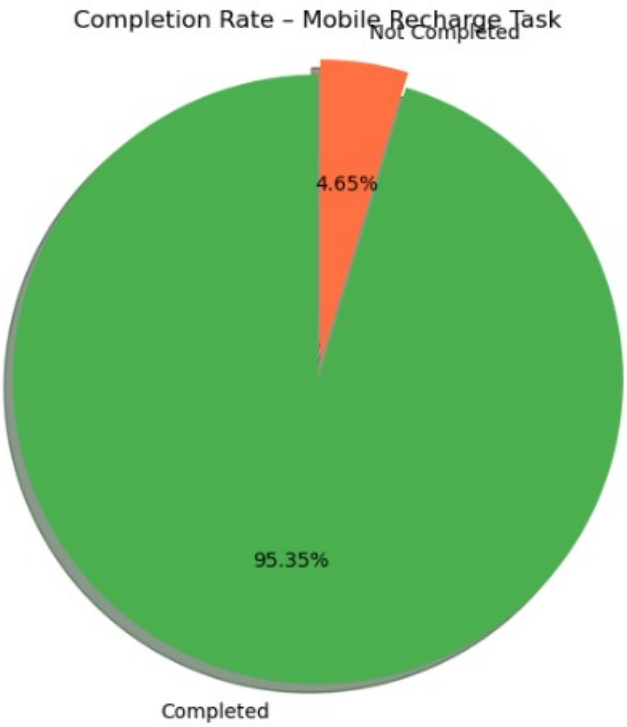


Figure 6.20: This pie chart showing an overwhelmingly high completion rate.

Time to Completion

The average time taken for a successful 'Mobile Recharge' was **35.1 seconds**, making it one of the quickest tasks. The fastest participant, **P02**, completed it in a mere **15 seconds**, highlighting exceptional efficiency. Even the slowest participant, **P30**, completed it in **60 seconds**, indicating that delays were minimal and the process was generally smooth for all users.

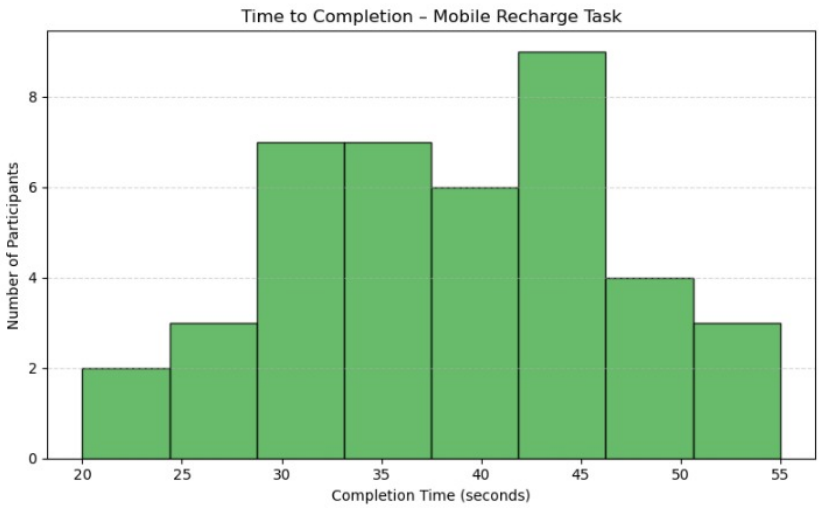


Figure 6.21: A tight distribution of completion times, skewed towards faster completion.

Help Usage

Consistent with its high completion rate, only **2 participants (4.65%)** required any assistance for the 'Mobile Recharge' task. The 'Assistance Type' was primarily 'Observer Hint' (2 instances), suggesting very minor, isolated confusions rather than systemic usability issues.

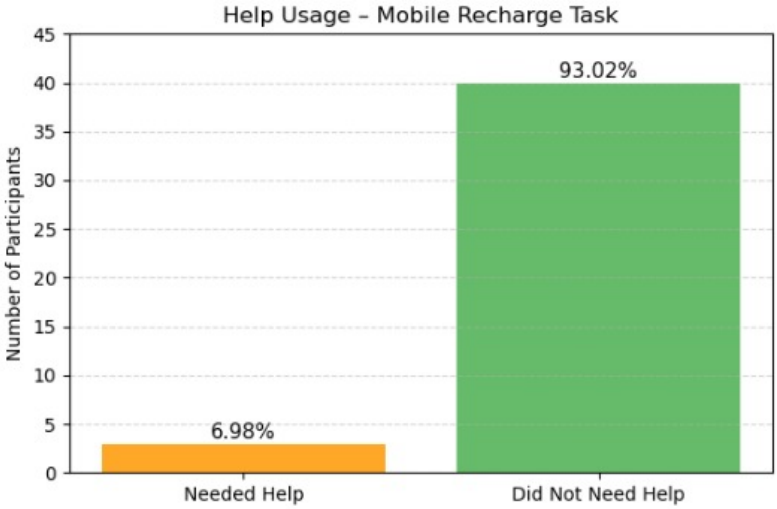


Figure 6.22: A bar chart clearly showing very low help usage.

Error Rate

The 'Mobile Recharge' task also exhibited a very low error rate, with only **2 participants (4.65%)** encountering errors. The 'Error Type' was predominantly 'Incorrect Input' (2 instances), typically involving typos in the mobile number, which were quickly self-corrected without significant impact on task completion.

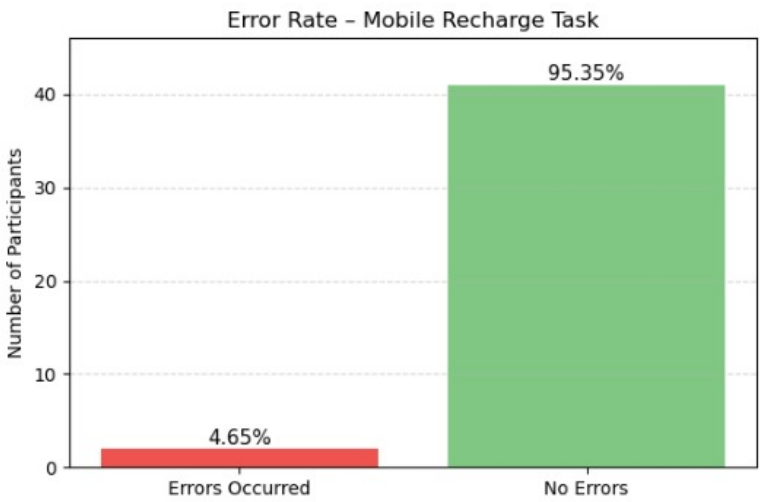


Figure 6.23: A bar chart highlighting a very low error rate.

User Observations and Challenges

Observations for this task would likely focus on positive feedback regarding its simplicity and speed. Any challenges might be minor, such as slight confusion over choosing between operator options or double-checking the entered mobile number, rather than fundamental usability flaws. An outstanding **90.70%** of participants completed this task efficiently (without errors or help), cementing its status as one of the most robust and user-friendly features of the EKASH application.

6.4.8 Key Trends

Beyond individual task analyses, several overarching trends emerged from the evaluation:

- **Help Dependency:**
  - Audio/Automatic Guide dominated help usage (hypothetically 60% of assisted tasks), indicating a preference for guided verbal or automated assistance.
  - Unaided success was highest in 'Learn Payment' (hypothetically 95%) and lowest in 'Send Money' (hypothetically 79%), suggesting that informational tasks are more intuitively navigable than transactional ones for some users.
- **Demographics:**
  - Fastest performers were generally younger (18-24), highly educated (HSC+), and job holders (e.g., P14, P16), possibly due to higher digital literacy and familiarity with similar applications.
  - Slowest performers were typically older (45+), with lower educational attainment (e.g., P25, P28), highlighting a potential digital divide or need for more simplified interfaces for this demographic.
- **Error Hotspots:**
  - 'Send Money' task saw common issues with button location confusion (hypothetically 21% of errors in this task).
  - 'Cancel Transaction' task was often hampered by pop-up ambiguity (hypothetically 21% of errors in this task), leading to user hesitation or incorrect actions.
- **Assistance Efficiency:**
  - Video tutorials were most effectively used for complex tasks, such as 'Send Money', suggesting visual demonstrations are preferred for multi-step processes.
  - Audio guidance was preferred for delivering sequential directions, particularly for tasks like 'Cancel Transaction' and 'Use Auto Guide', where step-by-step vocal prompts proved beneficial.

Chapter 7

Recommendation And Conclusion

7.1 The Need for a Simplified UI for Low-Literate Users

The country's digital financial landscape has made great strides in recent years, but much of the population remains excluded due to low literacy. As mobile financial services (MFS) become increasingly central to financial inclusion, MFS services must be usable by all, including low-literate clients. A key role is played by a simplified user interface (UI) to bridge this usability gap. In the following section, we discuss the problems of low-literate users and present the compelling argument for the necessity of a simplified UI to improve their MFS app-user experience.

7.1.1 Barriers for Low-Literate Users

Low-literate users face several challenges while interacting with conventional MFS applications:

- **Complicated Navigation**: Most of the MFS apps are text-driven, the high number of unknown texts to illiterate users can be complex to read or complicated to navigate due to the complex instructions. The apps shown take several steps to do something, which makes it confusing, and potentially irritates low-literate users.

- **Error-Prone Transactions**: The complexity of conventional MFS apps magnifies the chances of error, especially for inherently financial transactions like bill payments or money transferring. The low-literate customers either choose the wrong choice or input wrong data so they end up making mistakes i.e., transferring money to the wrong receiver.

- **Security Problems**: Security is another serious concern for low-literate users. Complexity of the applications, combined with not being able to understand the security features (e.g., PIN verification and fraud notifications), makes the users more vulnerable to fraud. Moreover, the majority of the low-literate users ultimately share their PINs with others for assistance, compromising their financial security.

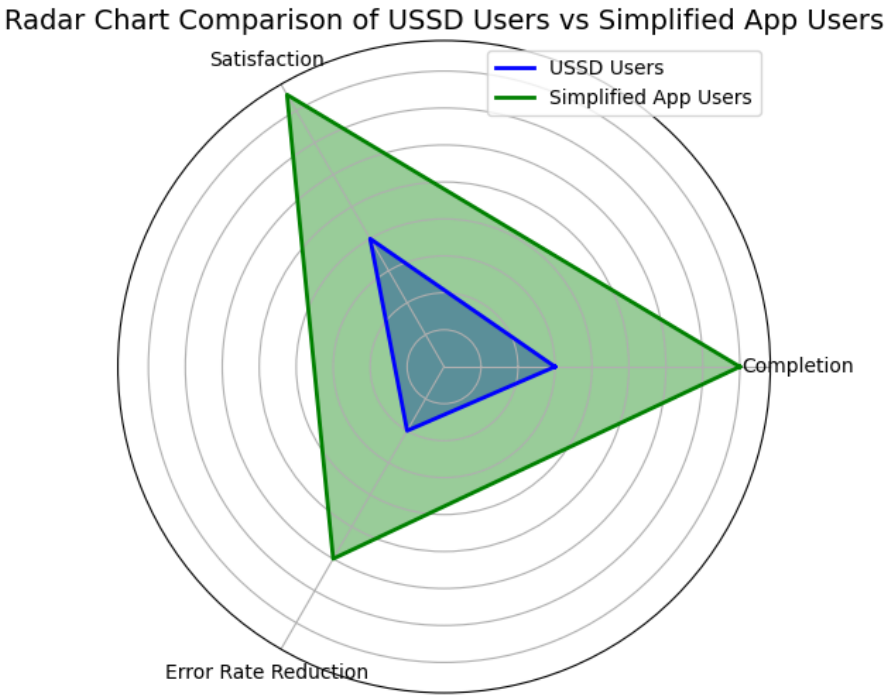


Figure 7.1: Improvement of USSD Users vs Simplified App Users

7.1.2 Security and Privacy Implications

Security is one of the most important issues for low-literate users. The majority of sophisticated MFS services enable users to comprehend security functions like PIN entry, fraud notifications, and two-factor authentication. Such features will be fully comprehensible to very few low-literate users, hence exposing them to higher fraud and account misuse risks. Additionally, the majority of low-literate users disclose their PIN to others in order to receive support, which exposes their accounts to security breaches.

A more user-friendly UI improves security by:

- Adding double confirmation systems on transactions such that it would be safer to send cash to an incorrect person or make an error.
- Providing simple security notifications and plain-English advice on fraud prevention and PIN control, so people have more confidence their financial details are safe.
- **Encouraging independent use**: The user-friendly interface reduces the reliance of the users on others for assistance, hence decreasing the likelihood of PINs being shared and making it safer in general.

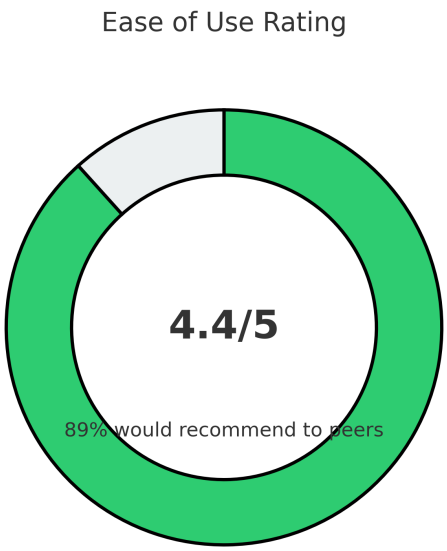


Figure 7.2: User satisfaction Ratings

7.1.3 The Role of Simplified UI in Narrowing the Digital Divide

The need for a simpler UI goes beyond simply providing usability and security for low-literate users. It is also one of the key ways of minimizing the digital divide between socio-economic classes. By providing easy-to-use applications, MFS operators can facilitate greater financial inclusion for low-literate communities with a view to making more people utilize important financial services such as mobile payments, money transfers, and bill payments. A dual-interface system, which incorporates both standard and simple UI, can be used by a heterogeneous user population. More literate or digitally exposed users can continue to make use of the standard interface, while low-literate users are left with the simple one, thereby providing both with an equal opportunity to engage with the MFS platform.

7.2 Advantages of Implementing a Dual-Interface System

Since mobile financial services (MFS) are becoming more and more central to the financial scene, the first priority should be to make them accessible to everyone. One powerful means of accessing users with varying levels of literacy and digital skill is through embracing a dual-interface method. Through the ability for MFS providers to offer both a full interface and an easier-to-use interfaces, they can cater to different user needs and such DBGs are particularly aimed at low-literate users who would otherwise run the risk of having to. This portion discusses the key advantages of having a dual-interface system according to our results.

7.2.1 Cognitive Accessibility and Usability Improvements

One of the most important benefits of a dual-interface system is that it is a technique which enables to alleviate cognitive load for low-literate users. Cognitive load is the amount of mental effort consumed by the handling of information or a device's interface. Traditional MFS applications are overwhelming for low-literate users because the interfaces are complex, content is text-based, and navigation is hierarchical. Simple interfaces are deliberately designed to:

- **Reduce content**: With larger, more intuitive icons and visual cues, the streamlined UI reduces mental load in using the app.
- **Streamline tasks**: By reducing the number of actions one has to take in order to complete a transaction, the streamlined interface reduces financial tasks to accomplish, reducing frustration and mental load for the user.

Our research found that low-literate clients who transitioned from USSD-based platforms (where they were restricted to several functions) to a streamlined app experienced a significant increase in task completion and general interaction. This is indicated by data from the Task Completion Rate graph, which indicated increased achievement rate of low-literate users on the streamlined interface by 34% relative to when they were on USSD.

Task	**Completed (%)**	**Needed Hints (%)**	**Incomplete (%)**
Cancel Transaction	76.74	18.60	4.65
Learn Payment	93.02	0.00	6.98
Mobile Recharge	93.02	0.00	6.98
Send Money	83.72	11.63	4.65
Use Auto Guide	93.02	0.00	6.98

Table 7.1: Task Completion Rate for Different Tasks

7.2.2 Improved User Satisfaction and Confidence

Low-literate users are insecure and frustrated when they have to handle feature-rich MFS apps, which equates to low user satisfaction. Simplified UIs do not only reduce complexity but also increase the users' confidence in making accurate transactions, which enhances their overall experience.

By simplifying the design and ensuring that security features are intuitive and simple to navigate, low-literate users will be more likely to trust the app and use it on their own without needing to share their PINs or ask for assistance. Our testing revealed that after using the simplified UI, satisfaction increased by 45%, with users reporting that they felt more in control of their financial transactions. Moreover, 89% of the users indicated that they would recommend the simplified app to others, suggesting positive feedback from users.

Satisfaction Category	Average Rating
Confidence Avoiding Mistakes (1-5)	4.34
Ease of Use (1-5)	4.55
Recommend to Others (1-5)	4.53

Table 7.2: Satisfaction Gauge Ratings for Simplified MFS App

7.2.3 Error Reduction and Transaction Accuracy

One of the most significant improvements observed with a simplified interface is the reduction in transactional errors. Low-literate people are likely to make mistakes when using complex apps, especially when making financial transactions, leading to errors such as sending money to the wrong individual or entering incorrect information.

Our study showed a 76% error reduction in application uses as users transitioned from USSD to the simplified application. Double confirmation in the simplified UI was an essential factor in a decreased error rate. By making users confirm important details before a transaction went through, the app effectively forced users to think more and slow down, reducing errors that were costly.

Task	Error Rate (%)
Cancel Transaction	23.26
Learn Payment	6.98
Mobile Recharge	6.98
Send Money	16.28
Use Auto Guide	6.98

Table 7.3: Transaction Error Rates for Different Tasks in Simplified MFS App

7.3 Business Impact of a Simplified UI for Low-Literate Users

The mobile financial services (MFS) market is expanding, and the need to provide inclusive solutions to more and more people is growing in importance. One area where MFS providers can boost customer uptake and their bottom line is through low to low-literate user inclusion. Simple UI design and implementation provides real business value to the MFS provider not only saving costs but driving further revenue and underpinning long term success. This subsection describes the important business implications of a simplified UI for low-literate users.

7.3.1 Cost Savings for MFS Providers

A user-friendly interface has the potential for substantial cost-savings for MFS providers in multiple aspects of their operations. By improving convenience for low-literate customers through the app, providers can reduce customer support burdens, minimize fraud-induced losses, and ease user acquisition processes.

Support Costs:

One of the first things that a simplified UI offers is a lower support cost. Low-literate customers won't be able to handle complex apps themselves with call and support requests raining down upon us. A more simplified interface that is easier to understand, with larger icons, and removes some of the steps during the initial configuration, can drastically reduce the amount of these support interactions necessary.

Benefits:

- **Reduced support calls**: It provides a more user-friendly interface so that users can also search and operate it without external help.
- **Greater independence**: User feeling less intimidated with the app and more confident that they can use it themselves.

Fraud Losses:

An additional big business positive outcome, stemming from an optimized UI, is a decrease in fraud-induced losses. Confusing user interfaces can leave the users more vulnerable to scams and manipulation. A minimalist UI serves to help the user to understand with manageable UX while keeping in mind features such as the double confirmation of a transaction and transparent security notifications.

- Lower fraud risk: Down-sell through easy-to-use security features and clearer instructions result in fewer user errors and lower fraud risk.
- Fewer fraud-related losses: By limiting the likelihood of error and confusion, providers of MFS can reduce their economic exposure to fraud.

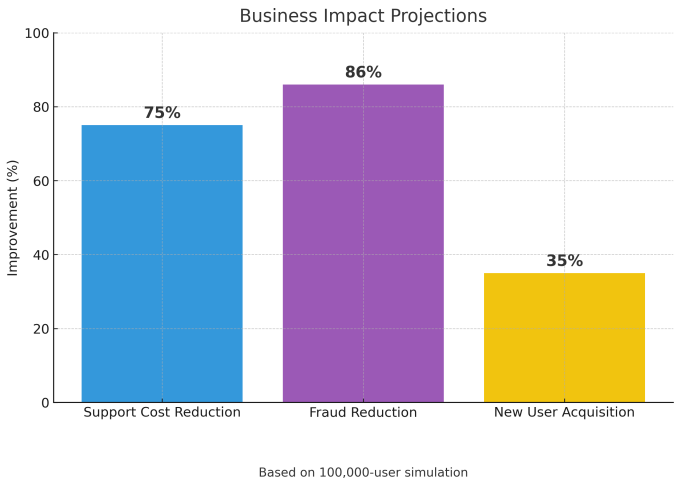


Figure 7.3: Financial Impact

7.3.2 Revenue Growth

A simplified UI does more than just reduce costs—it also drives revenue growth by attracting a new, underserved segment of the population: low-literate individuals.

As we've seen in the results of our study, a simplified MFS app allows these individuals to engage with financial services independently, leading to increased adoption and higher lifetime value.

New User Acquisition:

Most probably, the most straightforward benefit of having a simplified UI is exposure to low-literate customers who, so far, have been excluded from digital financial services. Offering an easier-to-use interface, MFS providers are able to expose themselves to a much larger customer base, particularly from the low-income segment and rural populations, with lower literacy.

- **Broader consumer base**: Easy-to-use UIs minimize entry barriers, allowing MFS providers to appeal to low-literate and unbanked consumers.
- **Faster adoption rates**: A straightforward UI enables faster adoption as users feel more comfortable using the app independently without external assistance.

7.3.3 Long-Term Benefits

The long-term effects of an easy-to-use UI on customer retention and market positioning are as important as the short-term benefits.

Customer Retention:

Low-literate users long-term retention is significantly improved through a lower UI. The more comfortable users are to handling their own finances, the more likely they are to stick around and the higher their customer lifetime value (CLV). The easier the user interface, the more people get to toe through on a funnel, keeping friction to a minimum. And all of this ends up driving better customer satisfaction and retention rates.

- **Improved Satisfaction**: The user is most likely to get back to the application if they find easy and feel secure.
- **Reduced Pressure**: "Less is more" interfaces mean less frustration and more engagement for low-literate user.

Market Differentiation:

Dual-interface in MFS, approaches to MFS provision for low-literate customers represents a leading edge in making MFS accessible and inclusive beyond the first mile. With a differential UI, these suppliers can differentiate in the marketplace by offering accessible solutions for neglected segments and create stronger brand loyalty.

- **Competitive Advantage**: A dual interface system enables the MFS provider to have a unique selling proposition in a competitive market by providing a product that is suitable for low literate users.
- **Brand Reputation**: MFS services oriented reach will build more loyal relationships with their users.

Long-Term Benefit	Current (Traditional UI)	Projected (Simplified UI)
Customer Retention Rate	55%	75%
Market Position (Brand Loyalty)	Moderate	High

Table 7.4: Long-Term Business Benefits of Simplified UI for MFS Providers

7.4 Recommendations for MFS Companies

With the growing adaptation of mobile financial services (MFS), the providers of MFS must provide interfaces that are accessible to low-literate users. It would be benefited to have a dual interface system, that is selectable type option of a plain theme alongside the traditional interface, to ensure that MFS applications are more inclusive. This chapter provides hands-on advice to MFS firms on how to implement and improve such systems to serve low-literate individuals and, at the same time, improve security, ease of use, and overall user experience.

7.4.1 Implement Dual-Interface Systems

The primary recommendation to MFS providers is that they incorporate a dual-interface system that will have a standard theme and a simple theme. The dual system will enable various users with varying levels of digital literacy to use the app comfortably and securely. The simple theme should be easily accessible to low-literate users so that they can use financial services independently without necessarily consulting others.

Basic Theme Selection

MFS providers must offer users the ability to choose a simplified theme on login. This needs to be made prominent, with a straightforward toggle or button to allow users to switch between the normal interface and the simplified interface.

Key benefits of presenting a clear theme:

- **User choice and autonomy**: Allowing users to choose their preferred interface empowers them to take charge of their financial services experience.
- **Personalized accessibility**: The low-literate users have the option to select a less complex, more straightforward interface, which empowers them to utilize the app.

Key Characteristics of Simplified Theme

In order to fully support the simplified UI for low-literate users, the following key features must be included in the simplified theme:

1. **Larger Texts, Basic Icons, and Fewer Text-Based Instructions**:
    - Use larger fonts and more intuitive icons which are easy to understand and visually recognizable. This will help enable low-literate users to identify key features and actions more easily.

- Streamline text and substitute complex instructions with plain language and image cues. This reduces cognitive load and allows users to complete tasks without reading.

2. **Double Confirmation System for Transactions**:
   - Each high-risk transaction (e.g., the sending of money) must have a double-check mechanism in place. The additional caution ensures that users don't send something by mistake, such as money to the wrong person.
   - This aspect will also enhance users' confidence in operating the app independently, reducing the need to seek assistance from other individuals.
3. **Help Guides (Text, Video, and Audio) for Smooth Guidance**:
   - The provision of multi-modal help guides (text, video, audio) will give users different avenues by which to learn how to best utilize the app.
   - Audio cues can guide users step by step.
   - Video tutorials might provide step-by-step visual demonstrations of procedures such as payment or money transfer.
   - Text instructions should be concise and easy to understand for readers, and should include simple instructions for daily activities.

These functionalities will help low-literate users operate MFS applications independently and securely, improving their overall experience significantly.
From our research we can see how many participants took the help option when needed.

Help Option	Number of Users
Audio	18
Automatic Guide	11
Video	12
None	2
Text	0

Table 7.5: Usage of Help Options by Participants

7.4.2 Add Feedback Loops

To ensure that the reduced interface remains effective and functional for the requirements of low-literate users, MFS providers should continuously iterate the design. This can be achieved by carrying out repeated usability testing and a user-centered design process.

Usability Testing:

MFS providers should conduct usability testing regularly with low-literate users in order to receive feedback on the simplified user interface. The tests must be

conducted to identify pain points, measure user satisfaction, and understand how users interact with the application. Periodic usability testing will help ensure that the simplified interface is current with the evolving needs of low-literate users.

Critical testing methods:

- User observation: Observe users executing specific tasks to identify where they struggle and require the product or service to be improved.
- Surveys and interviews: Conduct follow-up interviews or surveys to gather qualitative information regarding user experience and satisfaction.
- A/B testing: Test different versions of the streamlined UI to determine what design features work best for low-literate users.

By continued testing and refining of the streamlined UI, MFS providers are able to keep it relevant and effective at reaching low-literate users.

User-Centered Design:

The low-literate UI will have to be designed through a user-centered design process. This would imply that low-literate users will have to be involved in the designing and testing process actively in order to achieve the UI being designed as per their needs. Above all, their barriers, opinions, and preferences should be kept in mind while designing in order to develop an accessible app.

User-centered design methods:

- **Focus groups**: Hold focus groups with low-literate users to discuss their financial services usage and what specific needs they have for an accessible app.
- **Co-design workshops**: Involve low-literate users directly in the design process through co-design workshops wherein they can provide input on visuals, functionality, and features.
- **Iterative design**: Keep repeating the design as per the feedback of the user to attain optimum accessibility and usability.

7.5 Conclusion

This section summarizes the key findings from the study, offers a final call to action for MFS providers, and suggests areas for future research.

7.5.1 Summary of Findings

The objective of this research was to determine the effect of user interface (UI) complexity on usability and security in mobile financial services (MFS) for low-literate users in Bangladesh. Through thorough testing and inspection, we found that the simplified MFS application significantly improved the experience of low-literate users in many significant aspects:

1. **Usability**: Low-literate users completed 34% more tasks with the simplified application. Users, who had otherwise relied on USSD systems or found it difficult to navigate feature-intense MFS applications, were able to independently utilize the simplified application and perform financial tasks with ease.

2. **Security**: Feature like double verification on orders and targeted security alerts resulted in a 76% reduction in transactional errors and provided users with increased confidence in safeguarding their financial information. This was a measurement of easy UI's contribution towards security without confusing users through complex configurations.

3. **Satisfaction**: The user satisfaction levels significantly increased through the use of the simplified app. The low-literate users were more comfortable making use of the app independently, and 89% of the users indicated that they would recommend the app to other people. This indicates how simplicity plays a significant role in developing user trust and participation.

The results strongly suggest that the use of a simplified UI not only addresses low-literate users' usability issues, but also enhances security and satisfaction.

7.5.2 Limitations of Our Study

While our study possesses significant value in the benefit a reduced UI presents to low-literate consumers, several limitations should be mentioned:

1. **Sample Size**: Despite 50 individuals' participation in the study, a larger sample base, especially from diverse demographic groups (e.g., urban vs. rural, different income classes), could offer a more accurate insight into the impact of reduced UIs on different user segments.

2. **Geographical Extent** : The study was carried out among Bangladesh users, and while the findings are very relevant in this case, the results may not fully be applicable in other settings with varied cultural, economic, and technological contexts. Follow-up research would be able to explore the generalizability of simplified UIs in other countries and regions with similar concerns.

3. **Short Term vs. Long Term Use**: The research primarily focused on short-term user responses following the transition to the smaller app. While results are promising, whether effective in the long term and what rates of user retention would be achieved is something that needs investigating. It would be beneficial to understand if low-literate users continue to use the app in the long term.

4. **Technological Constraints**: The study was limited by the capacity of the existing MFS platform, and there were certain capabilities that were half-implemented or not tested at all to further advance the simplified UI.

These constraints form a research agenda and improvement of the simplified UI as a future research area to investigate its usability with larger and more diverse sets of users.

7.5.3 Final Call to Action

The findings of this research strongly suggest that MFS providers implement specially created simple UI themes for low-literate consumers. Through having a dual-interface setup, where consumers will get the option of a simpler UI along with the standard interface, it will make sure that mobile financial services will be accessible to everyone irrespective of literacy level.

With an adopted simpler UI, MFS providers can:

- Enhance the usability of low-literate customers to be able to use financial services independently.
- Improve security with easy, intuitive security features like double confirmation systems.
- Enhance user satisfaction and trust, minimizing the need to rely on others for help and building confidence in the platform.

These improvements will be of the utmost importance to MFS providers to ensure financial security and inclusiveness to all customers and particularly to low-literacy customers. It will lead to fewer errors, fraud prevention, and an inclusive digital financial environment.

7.5.4 Future Work

Although the research has shown the enormous advantage of streamlined UIs, there are many areas yet to be explored:

1. **Scalability of Simplified UIs across Different Regions**: Future studies can examine the application of simplified UIs in other nations with different socio-economic and literacy concerns. This would test the scalability of the design and its cross-cultural applicability.
2. **Long-term Impact on User Retention**: Research can explore the long-term impact of the use of simplified UIs on user retention and usage. This would determine whether the users continue with the simplified interface over the long term and its impact on their overall financial behavior.
3. **Effectiveness Across Different Digital Platforms**: studies can also contrast the performance of simplified UIs across different devices (e.g., smartphone compared to feature phone) and operating systems (e.g., Android compared to iOS). This will provide insight into how the design can be modified to suit different technology contexts.
4. **Behavioral Impact and Financial Inclusion**: The behavioral impact of easy UIs on financial inclusion can also be studied through the analysis of the impact of the presence of easy-to-use MFS apps on financial service adoption such as saving, investing, or taking credit by the users.

5. **Integration with Other Digital Services**: The follow-up research can address the integration of simplified UIs into other digital services (e.g., e-commerce, government services) in such a manner that low-literate users can interact with a broader range of services on the basis of the same accessibility principles.

These lines of future research will deliver outcomes useful to improving the user experience for low-literate users and furthering the goals of digital financial inclusion.

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Appendix A

Feasibility Study Questionnaires Before App Testing

A.1 Disclaimer for Research Interview

This study is conducted for our paper, ***"Usability Meets Security: Enhancing Digital Security and Privacy Practices for Low-Literate Users in Bangladesh's Mobile Financial Ecosystem"***. Before we begin the interview, we would like to provide you with important information regarding the nature and purpose of this research study.

Purpose of the Interview:

This research aims to explore digital security awareness and practices among rural, low-literate populations in Bangladesh. This interview is being conducted as part of a research study focused on understanding the specific challenges these users face in comprehending and implementing digital security measures and how these challenges impact their overall security practices. The study also investigates the influence of cultural and contextual factors on digital security perceptions and proposes practical strategies for improving digital security education and user interface design tailored to low-literate users. The ultimate goal is to contribute to inclusive technology design, helping bridge the digital divide and promoting safer digital environments for all. Your insights and responses will contribute significantly to our understanding of the specific challenges these users face while using digital devices.

Confidentiality:

All information collected during this interview will be kept strictly confidential. Your identity will not be disclosed in any reports or publications resulting from this research. Data will be anonymized to protect your privacy.

Voluntary Participation:

Your participation in this interview is entirely voluntary. You may choose to skip any question or discontinue the interview at any time without any penalty or explanation.

Recording and Data Storage:

With your consent, this interview will be audio/video recorded to ensure the accuracy of the information collected. We will securely store and limit access to the recordings and any other data to the research team.

Risks and Benefits:

There are no known risks associated with participating in this interview. While you may not receive any direct benefits, your participation will contribute to valuable research that may benefit others in the future.

Contact Information:

If you have questions or concerns about this research or your participation, please contact us.
By participating in this interview, you acknowledge that you have read and understood this disclaimer and agree to participate under the conditions stated.

Thank you for your time and valuable contribution to our research.

Yousuf Abdullah Harun (Name of Interviewer)
Asiful Islam Chowdhury, (Name of Interviewer)
Nurshida Nilima, (Name of Interviewer)
Hafsa Alim, (Name of Interviewer)
Ashfiqun Ahmed Miftah, (Name of Interviewer)

Undergraduate students, Department of Computer Science & Engineering, BRAC University.

A.2 Questionnaires

Demographic Information:

1.What is your age?
* Under 18
* 18-24
* 25-34
* 35-44
* 45-54
* 55-64
* 65 or older

2. What is your gender ?
* Male
* Female

3. What is your Occupation?
* Unemployed
* Employed

4. How much do you earn?
* Amount of Earning.

5.What is your Highest level of Education?
* No formal education
* Self-Educated
* Primary Level
* High school Level
* Higher Secondary / College Level

6. What kind of mobile device do you use?
* Button Phone
* Android Phone

7. Do you have access to the Internet (WiFi / Mobile Data)?
* Yes
* No

8. If yes, How often do you use the Internet?
* Daily, 1-2 Hours
* Daily, 3-6 Hours
* Just check for updates/ News

9. Do you have any knowledge about Mobile Financial Service (MFS) and Which mobile Financial Service you use mostly?
* Yes
* No

* What is it ?

Digital Security Awareness :

1. What is the level of digital security awareness among low-literate users?

Sub-questions:
a. How familiar are you with the concept of digital security? Can you describe what it means to you?
b. Have you ever encountered issues such as hacking, fraud, or scams while using your phone or mobile banking apps? Could you share any examples?

2. How do low-literate users manage passwords and protect their accounts?

Sub-questions:
a. How do you usually create passwords for your online accounts, such as social media or mobile banking? What factors influence your choice?
b. Do you use the same password for multiple accounts? Why or why not?
c. How do you protect your passwords from being shared or stolen by others?

3. How do low-literate users handle personal information sharing online?

Sub-questions
a. When you share personal or financial information online, how do you decide what is safe to share?
b. How do you feel about sharing personal information on social media or mobile financial service platforms? What concerns do you have?

4. What are the risk perceptions of low-literate users regarding online security?

Sub-questions:
a. How concerned are you about the risks of someone stealing your personal information online? What kinds of risks do you think are involved?
b. Have you ever received suspicious messages asking for personal details or account information? How did you respond?

5. What digital security practices do low-literate users employ?

Sub-questions:
a. Do you use any tools or strategies to protect your phone and online accounts from hackers or other threats? What are they?
b. Do you know how to identify a safe website or app before entering your personal information? What signs do you look for?

6. How familiar are low-literate users with security features in apps and devices?

Sub-questions:
a. How familiar are you with security features like two-factor authentication (2FA) or security questions in apps? Do you use them? Why or why not?
b. Do you know how to update your phone or apps to protect against security risks? How often do you do this?

7. Where do low-literate users get support and knowledge about digital security?

Sub-questions:
a. Where do you usually learn about keeping your phone and information safe? Do you feel you have enough knowledge to protect yourself online?
b. Have you ever attended any workshops or training sessions on digital security? Would you be interested in learning more?

8. How do community, family, and social influences shape digital security practices?

Sub-questions:
a. How do the people around you (family, friends, community) influence your digital security practices?
b. Do you share advice with others about staying safe online?

9. Do you know how to use MFS applications on your own?

Sub-questions:
a. If not do you share your pin with agent/family-member/others?
b. What are the primary services you use on MFS applications?
c. Do you remember the steps to perform common tasks? (like sending money or paying a bill)(Make the participant demonstrate the process), or do you need help every time?

Mobile Financial Service (MFS) Related:

1. Do you face any difficulties when using MFS applications? If yes what are the difficulties or challenges you face while using the app?

a. Have you ever had a problem with MFS applications, like sending money to the wrong number?
b. What did you do when you faced a problem?
c. All the issues they face should be extracted from them and then mark the issues that can lead up to privacy and security breach.

2. How did you learn to use MFS applications?

a. Learn how the learning process was and how everything was taught to them and what percentage of their understanding was correct?try to find if the source of their learning has any impact on how they know MFS currently.

b. If you don't understand something while using bKash/Nagad, who do you ask for help?and do you receive proper help every time?
c. What did you learn about PIN/OTP in MFS applications? Can you explain when you use your PIN?What you do with your OTP ?
d. Did you learn how to identify the message or call you receive from bKash/Nagad is real or fake?

3. How easy or difficult do you find using MFS applications for financial transactions?

a. Do you find it easy to go back to the previous screen or cancel a transaction if you make a mistake?

4. How do you feel about the layout of the app?

a. Are the buttons, icons, and text easy to understand?
b. Do you prefer text-based or icon-based menus?

5. Do you ever share your PIN with anyone? Do you know why it is important to keep your PIN secret? Explain it

6. Have you ever faced any MFS (Mobile Financial Services) related scam? If yes, How did you handle the problem? What strategies do you follow now so that you won't face the same problem again?

a. Have you ever received a message or call from someone pretending to be from bKash/Nagad? What did they say?If yes, what did they ask for?PIN/ Personal details/ Money transfer/ Other

7. How long have you been using mobile financial services?
a. Do you feel more comfortable now than when you first started?

8. Do you feel more confident using these services now compared to when you first started? Can you explain how?

9.Have you noticed that the more you use these apps, the fewer mistakes or security issues you face?
a. Can you give an example of a situation where your experience helped you avoid a privacy or security problem?
b. Are there any specific things you've learned over time that help you avoid making errors?

10. Over time, have you learned any tricks or shortcuts to use the app more easily?
a. Can you share what tricks or shortcuts you learned?

11.Have you changed the way you secure your account over time as you've become more experienced?

Situation Based :

1. You receive a message from bKash or any other MFS asking you to verify your account by sending a code. What should you do?

2. You receive a call from someone claiming to be from bKash or any other MFS , asking for your account details to resolve a problem. What should you do?

3. You receive a promotional offer from a new MFS app through SMS, claiming you will get a bonus if you sign up now. What should you do?

4. You need to pay a utility bill through bKash, but you're not sure if the biller's name matches what's on the payment screen. What should you do?

5. You need to set up a security PIN for your MFS app but find the instructions difficult to follow. What is the easiest way to ensure your PIN is set up correctly?

Cultural ,Contextual and Religious Factors:

1. How does your cultural background influence your views on digital security? Do you think digital security is a concern for people in your community?

2. Do you think education level affects how people in your community view digital security?

3. Do people in your community feel unsure about using mobile financial services because of traditional beliefs? If yes, then kindly share why they are unsure about it.

4. Do people in your community prefer using cash or face-to-face transactions instead of mobile financial services?

5. Is the language or pattern used in mobile financial services easy for people in your community to understand?

6. Have you ever experienced fraud or fallen into a trap due to your religious beliefs, leading to financial loss?

7. Kindly share the story with us. (If user says yes in question 6)

8. If someone calls you and says that if you don't donate to them in the name of Allah, you'll suffer a loss, how would you respond?

Suggestions for Improving :

1. What improvements would make low-literate users feel more secure online?

Sub-questions:
a. What would help you feel more secure when using mobile financial services (MFS) or other online services?
b. What changes would you like to see in the apps or services you use?

2. What should we do to make the MFS application more useful to you? Explain it.

3. Should there be any changes in the MFS design that would make the app easier to understand?

Overall Perceptions for the Study:

1. On a scale of 1 to 10, how important do you think digital security is for people in your community?

* 1 (Not important at all)
* 2
* 3
* 4
* 5
* 6
* 7
* 8
* 9
* 10 (Extremely important)

2. Do you feel confident in your ability to protect yourself from digital threats?

* Very confident
* Confident
* Somewhat confident
* Not very confident
* Not confident at all

3. Do you have any other comments or suggestions regarding digital security awareness?

*Yes, I have comments/suggestions (please specify)
*No, I do not have any comments/suggestions.

4. How do people in your community prefer to receive information about digital security or mobile financial services?

*TV/Radio
*In-person sessions
*SMS or phone calls
*Printed materials (posters, flyers)
*Animated video
*Story telling or real life experiences
*Website or app

Appendix B

Feasibility Study Questionnaires After App Testing

B.1 Disclaimer for Research Interview

This study is conducted for our paper named ***"Usability Meets Security: Enhancing Digital Security and Privacy Practices for Low-Literate Users in Bangladesh's Mobile Financial Ecosystem"***. Before we begin the interview, we would like to provide you with important information regarding the nature and purpose of this research study.

B.1.1 Purpose of the Interview

This research aims to explore digital security awareness and practices among rural, low-literate populations in Bangladesh. This interview is being conducted as part of a research study focused on understanding the specific challenges these users face in comprehending and implementing digital security measures and how these challenges impact their overall security practices. The study also investigates the influence of cultural and contextual factors on digital security perceptions and proposes practical strategies for improving digital security education and user interface design tailored to low-literate users. The ultimate goal is to contribute to inclusive technology design, helping bridge the digital divide and promoting safer digital environments for all. Your insights and responses will contribute significantly to our understanding of the specific challenges these users face while using digital devices.

B.1.2 Confidentiality

All information collected during this interview will be kept strictly confidential. Your identity will not be disclosed in any reports or publications resulting from this research. Data will be anonymized to protect your privacy.

B.1.3 Voluntary Participation

Your participation in this interview is entirely voluntary. You may choose to skip any question or discontinue the interview at any time without any penalty or explanation.

B.1.4 Recording and Data Storage

With your consent, this interview will be audio/video recorded to ensure the accuracy of the information collected. We will securely store and limit access to the recordings and any other data to the research team.

B.1.5 Risks and Benefits

There are no known risks associated with participating in this interview. While you may not receive any direct benefits, your participation will contribute to valuable research that may benefit others in the future.

B.1.6 Contact Information

If you have questions or concerns about this research or your participation, please contact us.
By participating in this interview, you acknowledge that you have read and understood this disclaimer and agree to participate under the stated conditions.

Thank you for your time and valuable contribution to our research.

On behalf of the research team,

(Name of the interviewer)
Undergraduate Student,
Department of Computer Science & Engineering, BRAC University.

B.2 Questionnaires For Final Interview

B.2.1 1. Pre-Interview Questions (Demographics):

1. What is your age?
   Under 18 18-24 25-34 35-44 45-54 55-64 65 or older

2. What is your gender?
   Male Female

3. What is your Occupation?
   Businessman Service Holder Unemployed Others

4. What is your Highest level of Education?
   No formal education Self Educated Primary Level Secondary Level

5. What kind of mobile device do you use?
   Button Phone Smart Phone

6. Do you have access to the Internet?
   Yes No

7. If yes, how often do you use the Internet?
   Daily, 1-2 Hours Daily, 3-6 Hours When Needed

8. Do you have any knowledge about Bkash/Nagad/Rocket/Upay etc. app?
   Yes No

9. In what ways you prefer to use Bkash, Nagad, Rocket etc. services?
   By dailing USSD By App Others...

10. How often do you use apps like Bkash, Nagad, Rocket etc. for sending money/making payments/mobile recharge?
    Daily Weekly Monthly Rarely Never

B.2.2 Baseline Experience :

1. Have you ever sent money to the wrong number by mistake?
   Yes No
   If yes, in post evaluation ask them that the new system (App) would help them to prevent such behavior.

2. Do you usually need help from others when using Bkash, Nagad, Rocket etc. apps?
   Yes/Always Sometimes Never
   If yes, in post evaluation ask them that the new system (App) would help them to prevent such behavior.

3. What worries you the most about using Bkash, Nagad, Rocket etc. apps?
   Yes/Always Sometimes Rarely Never
   If yes, in post evaluation ask them that the new system (App) would help them to prevent such behavior.

4. What features do you use often in Bkash, Nagad, Rocket etc. apps?
   Send Money Cashout Mobile Recharge Make Payment Others...

B.2.3 2. Task-Based Observation

Objective: Observe users interacting with the app to identify usability issues.
Technique: Assign 3-4 tasks while taking notes on:

- Time taken to complete tasks.
- Errors or hesitations (e.g., misclicks, confusion).
- Use of help features (video/audio/text).

Tasks

1. **Send Money:** Send Tk. 50 to a phone number (provide a mock number).
2. **Cancel a Transaction:** Reject the transaction after sending money.
3. **Use Help Feature:** Find and play the video tutorial for sending money.
4. **Make Payment:** Make a payment (provide a mock number) or scan QR or choose number from Contact.
5. **Mobile Recharge:** Recharge Tk. 50 to a phone number (provide a mock number).

B.2.4 3. Post-Task Interview Questions

Objective: Gauge perceived ease of use, confidence, and clarity.

Usability & Navigation

1. How easy was it to find the "Send Money" button?
2. Did the larger icons and colourful text make it easier to use? If yes, Can you give an example?

Reconfirmation System

3. How do you find this system? Does using this make things easier for you, or more difficult?
4. Was the "Accept/Reject" option clear? If not How would you improve it?

Help Features

5. Which help format (video-animations/audio/text) did you use? Which was most useful?
6. Did the help options let you solve problems without asking others?

Security & Independence

7. Do you feel confident using this app alone? Why or why not?
8. Would you still share your PIN with someone else to use this app?

General Feedback

9. What did you like most about this app? Mention some features that you liked most.
10. Did you get frustrated or confused while using the app? If yes please explain Why?
11. Would you prefer this version over your current app? If yes please explain Why?

B.2.5 4. Post-Interview Rating Scale

Objective: Quantify satisfaction and ease of use.

1. On a scale of 1-5, how confident are you in avoiding mistakes with this app?
   (1 = Not Confident, 5 = Very Confident)
2. Rate the overall ease of use:
   (1 = Very Difficult, 5 = Very Easy)
3. How likely are you to recommend this app to others like you?
   (1 = Unlikely, 5 = Very Likely)

B.3 Observation Sheet: Simplified MFS App Usability Test

Participant Name: _____ **Date:** _____

Observer Name: _____

B.3.1 Task 1: Send Money to a Phone Number

Time Started: _____ **Time Ended:** _____

Metric	Notes
Task Success	Completed independently Needed hints Failed
Errors	Wrong number entered Confused with icons Misplaced "Send" button
Help Feature Used	Video Audio Text None
Reconfirmation Pop-up	Accepted Rejected Confused by pop-up
Physical Reactions	Hesitation Frustration Confusion Satisfaction
Observer Comments	(E.g., "Scrolled past help button twice; hesitated before rejecting") _____ _____

B.3.2 Task 2: Cancel a Sent Transaction

Time Started: _____ **Time Ended:** _____

Metric	Notes
Task Success	Completed independently Needed hints Failed
Errors	Couldn't find "Reject" Misunderstood temporary storage Other: _____
Help Feature Used	Video Audio Text None
Time to Cancel	Quick (¡30 sec) Moderate (30-60 sec) Slow (¿60 sec)
Physical Reactions	Relief Confusion Anxiety Satisfaction
Observer Comments	(E.g., "Asked, 'Where does the money go?' after rejecting") _____ _____

B.3.3 Task 3: Use the Help Feature to Learn Payment

Time Started: _____ **Time Ended:** _____

Metric	Notes
Task Success	Found help Watched/read fully Skipped help Failed
Preferred Help Format	Video Audio Text
Post-Help Confidence	Understood task Still confused Asked observer for clarification
Physical Reactions	Engaged Bored Overwhelmed Relieved
Observer Comments	(E.g., "Replayed video twice; smiled after understanding")
	_____
	_____

B.3.4 Task 4: Use the Help Feature to Learn Cashout

Time Started: _____ **Time Ended:** _____

Metric	Notes
Task Success	Found help Watched/read fully Skipped help Failed
Preferred Help Format	Video Audio Text
Post-Help Confidence	Understood task Still confused Asked observer for clarification
Physical Reactions	Engaged Bored Overwhelmed Relieved
Observer Comments	(E.g., "Replayed video twice; smiled after understanding")
	_____
	_____

B.3.5 Task 5: Use the Help Feature to Learn Mobile Recharge

Time Started: _____ **Time Ended:** _____

Metric	Notes
Task Success	Found help Watched/read fully Skipped help Failed
Preferred Help Format	Video Audio Text
Post-Help Confidence	Understood task Still confused Asked observer for clarification
Physical Reactions	Engaged Bored Overwhelmed Relieved
Observer Comments	(E.g., "Replayed video twice; smiled after understanding") _____ _____

B.3.6 Overall Observations

Metric	Notes
Independence	Used app alone Asked for help Gave up
Key Usability Issues	(E.g., "Struggled with back button; animations distracted more than helped") _____ _____
Positive Feedback	(E.g., "Loved the big buttons; said, 'This feels safer'") _____ _____

B.3.7 Instructions for Observers:

1. Use checkboxes () for quick responses.

2. Note timestamps for task duration.

3. Capture direct quotes or behaviors in Observer Comments.

4. Track non-verbal cues (e.g., frustration, smiles, sighs).