Analyzing Usability of Mobile Banking Applications in Pakistan

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Abstract:

Usability is a key factor in the quality of the product, which includes ease of use, user satisfaction and the ability of the user to quickly understand the product without practice. As smartphone usage increases, most organizations have shifted their services to mobile applications, such as m-banking. Most of the people uses banking services but hesitate to use m-banking due to complex interfaces. Usability researchers concentrate on the value of design simplicity so that users can perform a particular task with satisfaction, efficiency, and effectiveness. If a mobile app lacks one of these usability features, users may get confused while using the app. This research examines the key usability issues in existing m-banking after checking the usability satisfaction level through System Usability Scale. To compare and highlight a number of usability issues, the researcher used two types of usability evaluation method 'User Testing' and 'Heuristic Evaluation'. In heuristic evaluation expert users used two M-banking apps i.e., Bank of Punjab (BOP) and Muslim Commercial Bank/ Islamic Bank (MIB) to evaluate them against Neilson 10 heuristics and extract the usability issues in apps. The user testing is then performed by novic[1]e users which includes tasks (translated from extracted problems by heuristic evaluation). After completion on whole testing users filled the post-test SUS's questionnaire. The result shows that the overall success rate of the tasks was 83%, SUS score was 77 and overall relative time-based efficiency very 54.2%. The expert evaluators found 83% minor errors and 17% major errors. The finding of this paper shows usability problems and recommendations are provided to increase the usability of mobile banking applications at the end of this paper.

Keywords: *Usability testing; Think Aloud; System usability scale; User testing; Mobile Banking*

1. Introduction

In the major banking industry, the integration of information technology has created significant changes. Banks compete closely and try to attract more customers by facilitating them with more and more facilities. Mobile business is booming and its consumers are growing steadily. The main reason for this is that inexpensive telecommunications services are available.

The definition of m-banking is like a payment via mobile. M-banking provides banking clients the opportunity to send SMS notifications such as deposits and withdrawals, check account status, credit card details and provide account operational information. It also provides the user with the facility to pay their utility bills, transfer funds, etc [1].

The challenge today is to develop m-banking that can easily meet all users ' needs.

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User design involves specific challenges: the lives, needs and expectations of these users in developing countries such as Pakistan are likely to vary considerably from the perceptions of the designer. In order to avoid any inconsistencies, the design of m-banking must be developed in partnership with primary users and must require a thorough study of their experiences and problems. The end-user can also help to continually test and finish projects throughout the design process by identifying design flaws.

In addition to the design of these systems effectiveness, efficiency and satisfaction are considered important factors in the application design. The problem that is emerging in the computer science community is that the usability of applications is overlooked by many developers which causes problems [2]. The need for enhancing usability is therefore very important, and numerous researchers in this field have shown that the usability of software is affected by different factors. Usability is an important factor in the production of high-quality and usability products, such as websites and mobile applications.

The main purpose of interface design is the usability of a good system. The various usability models have shown that by examining them, applications that have a high-quality interface can be created with great help.

1.1. Usability

ISO 9241-11 states that the extent of usability is to be used by a specific user to attain the specific objectives in a specific context of application in terms of effectiveness, efficiency and satisfaction [3]. Learning and ease of use is a created entity for people. The subject you use may be a program, a web-based system, a tool, a procedure or anything else with which you can interact. A series of recent studies solely focused on mobile usability with the occurrence and the swift acquisition of Smartphone tech. The physical restrictions on cell phones and wireless networks mean that the right research method must be carefully chosen and the possible contextual factors to be known should be reduced if they are not central to design and mobile usability studies. The

assessment of product development and user experience is critical to the way in which the process model, product development and final outcome have been established. The usability and experience of the user are distinct, as they also consider the usefulness. By analyzing usability, we can better visualize aspects of software architecture usability before implementation. Then, it can help you identify the user interface's 3 major components. "The required components", "The user-friendly components" and "The components to run them". Mobile usability involves several mobility-related challenges such as: mobile frames, networks, various resolutions, small screen sizes, and capacity and limited processing capabilities and processing inputs. Features of usability make the product or system usable. In all other, the user must possess both subjective and objective experience if a system is to be used.

1.2. Literature Review

In the banking sector, m-banking is a vibrant topic because rapid technological changes increase competence. In this section, the related research literature helps to identify the variables related to the problem referred to earlier in the study.

Kaikkonen tested mobile applications' usability in his study. He performed two different tests, the first test was conducted in the laboratory and the second test conducted in natural environment of users. He found 22 different usability issues in mobile applications under observation [4].

There are four different application categories compared by Ryan and Gonsalves. They consist of the different types of applications based on web-based PC, device-based PC, mobile web and mobile devices. The worst performance has shown by mobile web-based applications. The low page display speed is the reason. The fact is data provided from the web is low. The speed of low-page viewing adversely affects usability. Ryan and Gonsalves ' analysis could lead to a significant gap in the functionality of both a mobile application and a PC application with the same features and capabilities [5].

The literature reviewed reveals that the usability of a user interface is not one "single dimension" property. Many usability attributes need to be considered and measured. Shackel proposed four-dimensional characteristics that impact product acceptance: efficacy, ability to learn, adaptability and attitude [6]. Siti Elliyana and Puspita Kencana Sari carried out a study on internet banking website of Mandiri bank of Indonesia with Nielsens's usability heuristics. The method of research used was a descriptive analysis, with hundred participants participating through questionnaires. According to this study, Mandiri internet banking does not fully implemented all heuristics. Heuristics which were judged not well, those were; error prevention, flexibility and efficiency of use, and aesthetic and minimalist design [2].

Adane kebkab used qualitative method (heuristic evaluation) to measure usability of banking website. He found different usability issues mentioned by experts. He also suggested ways to improve the usability of banking website by using user centered approach [7]. A method that examines the usability of mobile apps and recognizes the possibility of usability problems has been developed by Biel Grill and Gruhn. The SATURN method consists of five activities. These activities include the context of analysis, determination of scenarios, evaluation of scenarios, interpretation, review and tools. Biel Grill and Gruhn have used the mobile SATURN model and observed major usability problems [8].

Zereh Lalji and Judith Good studied the design of a mobile device for illiterate users. While the study adopted an incremental and UCD approach. They have tried to explain how the results from their study can be beneficial to non-traditional users in the fields of design [9]. Victor Ndako Adama and Ibrahim Shehi Shehu develop a prototype on m-banking for novice users on the basis of recommendations and guidelines found in literature. They involved novice users and tested their prototypes. The results showed that the satisfaction level of users increased with new prototype [10].

Bernhaupt provided a set of the 'classical' approaches and adds several theoretical innovations in the field of mobile devices and applications to test usability. He recommends incorporating both forms of field assessment and standard laboratory testing to accommodate many stages of the UCD and development procedure [11]. Amin Babazadeh Sangar presented the smart banking model to enhance the usability of mobile software. In this respect, four new "visibility," "design," "navigation" and "compatibility" factors were achieved. The proposed model was presented in accordance with the factors in the earlier studies and obtained factors from his research. They had created an application for a bank based on this model, following the proposed usability pattern by increasing the level of satisfaction [12].

Azham Hussain has shown a range of usability measures to assess m-banking's usability. Measurement and dimension have been produced through systematic literature review in the relevant previous studies [13]. Fatih proposed a model that helps solve complex problems in the evaluation process of M-banking services and improves the performance of M-banking operations [14].

2. Methods and Materials

To achieve the goals of this paper, in this study the researcher selected different mobile banking apps running in Pakistan to analyze the usability of these app and to check the issue faced by the diversity of mobile banking users so that the researcher can give recommendations to increase usability of mobile banking applications.

2.1. Evaluation Methods and Approaches

Following two usability evaluation methods in this research work.

2.1.1. Heuristic Evaluation

Heuristic evaluation is the evaluation method. It was formulated by Nielsen [15], based on a number of guiding principles of usability or ' heuristics'. It can be described as an exercise that involves a number of experts to make use of heuristics to identify usability issues of an interface with less effort and in short period of time. "Heuristic assessment is a widely recognized diagnostic approach for

critical usability challenges and is common in various disciplines" stated by Magoulas [16].

2.1.2. Approach

In this research 5 experts were chosen to evaluate the usability of the mobile banking app of BOP and MIB. Evaluators were given a set of 30 questions, 3 against each Nielsen 10 heuristics. Evaluators scored each sub-criterion with a 5-point Likert scale starting from strongly agree (0) to strongly disagree (4). Each heuristic violation identified needed to be explained by the evaluators.

After completion of heuristic evaluation, the duplicate usability violations were consolidated and combined. Finally, a severity rating was carried out to assess the extent of usability problems. The usability issue was assessed by each evaluator using the five-point severity rating scale of Jakob Nielsen [17]. Table 1 shows the scale of the severity rating.

TABLE 1. Nielsen Severity Rating for Usability Problems

0	This is not a usability problem at all
1	Cosmetic problem only – does not need to be fixed unless extra time is available on the project
2	Minor usability problem - fixing this should be given low priority
3	Major usability problem - important to fix, should be given high priority
4	Usability catastrophe - imperative to fix

2.1.3. User Testing

In this method of testing, different novice users were given typical tasks (translated from extracted problems by heuristic evaluation) on mobile banking app. These tasks were consisting on main functionality of m-banking app and the researcher used the results to see how the UI of m-banking app assists users in their tasks. Each task given to the user, had precise goal to test the usability goals/ principles on which the

researcher evaluate the system. User testing includes many methods like Coaching Method, Co-Discovery Learning Method, Performance Measurement, Questions asking Protocols, Thinking Aloud Protocol etc. We used "Think Aloud" Protocol.

- **Think Aloud**

"Think Aloud" protocols, in this a user worked on an interface and we encouraged them to "think aloud" say what they think and wonder, at every moment. "Think Aloud" conventions are of specific esteem since they center on a user's issues. This allows researcher to obtain a detailed picture of the behavior of users that can be analyzed to highlight usability issues. This protocol helped to record the user's time to perform tasks and to calculate the efficiency. It also helped researchers to monitor user satisfaction level and application effectiveness under observation.

List of Tasks

The following tasks were performed by the users in user testing.

- Balance checking
- Funds Transfer within bank
- Funds Transfer outside the bank
- Mobile Top-ups
- Bill Payments
- Deactivate Card
- Update Settings
- Approach

Users were requested to fill Pre-Test survey to know essential data about candidate with the goal that researcher can assess about the candidates i.e. novice, moderate or master in this area. Then method of test and what is expected from them was presented, together with the idea of "Think Aloud" convention and the assignments they should performed on the Mobile Banking Application. This ease-of-use testing directed so that just a single candidate at any given moment could play out the examination, so as to empower the cautious observing of their activities and conduct. At the end user have to fill Post-Test survey in which

questions regarding task which facilitates the research objective given. Each question has a rating 0 to 5 calculating the satisfaction level of candidate from "Strongly Disagree" to "Strongly Agree". At the end, we calculated the satisfaction level, effectiveness and efficiency of task performed.

2.1.4. Questionnaire

This study contains two questionnaires: pre-test and post-test. The pre-tests were utilized to collect demographic information from users, both for "Heuristic Evaluation" and "User Testing". The post-test survey was used for two purposes in the user test: 1) the user's viewpoints were obtained, and 2) the user's disappointment and/or satisfaction level calculated, when they using the "Mobile Banking App". As a post-test questionnaire, the researcher used SUS questionnaire. A simple and extensively-used 10 questions survey is the "System Usability Scale" (SUS) which provides qualitative calculations of system usability. In this study users were asked to rate the 10 declarations half of their agreement or disagreement positively, and half of them negative about the Mobile Banking App. For presenting outcomes, this study uses the scoring model that transforms a single score based on Brooke's standard measuring method into a single score.

• Sample of Candidates

In this research work, different types of users were chosen i.e. Novice and expert users. The aim was to measure the difference in performance among the two groups, which was achieved by observing attentively and closely the behavior of users throughout the user testing. 18 users were chosen for user testing out of which 9 were novice and 3 were experienced and 6 were moderate level users who don't use mobile banking app frequently. Users were also chosen from different age groups to achieve the research goals.

Below are the samples of users we chose for my testing.

• Businessman (Who frequently use App) → Expert level User

• Businessman (Who use only few times App) → Moderate level User

• Businessman (Who never user App) → Novice User

• Housewives

• Students

• Professionals

TABLE 2. Gender and Experience User's Group Distribution

User Type	No of Users	Gender		Total
		Male	Female	
Novice	9	7	2	
Moderate	6	4	2	18
Experienced	3	2	1	

TABLE 3. Gender and Age Wise User's Group Distribution

Gender	Age Class			
	20-25	26-30	31-35	Above 35
Male	3	2	4	4
Female	1	2	1	1

3. Results and Analysis

The results from the two methods ("Heuristic Evaluation" and "User Testing") that have been used in this experiment are shown in this section. It begins by summarizing each user's problems during the "user testing" and calculating usability metrics including satisfaction, efficiency and success rate of each task. Then researcher calculates the usability of the mobile banking app with the help of the system usability scale (SUS).

3.1. User testing Results

3.1.1. Tasks Analysis

It is not essential to evaluate all of the tasks carried out by the participants in great detail during the evaluation process. A comprehensive examination will be enough for some of the tasks most successfully performed. A more comprehensive explanation would be more suitable for the usability problems as well as other challenging tasks. The concise work needs to be scanned carefully in order to ensure they are a true example of mobile banking. Each of the tasks in this section is examined and analyzed to find out the possible causes of the results of the work performed by the participants.

novice female user. Data collected via "Think Aloud" protocol found that it was the easiest task for almost all users and completed within few seconds after login. Most of the Mobile Banking Apps show their balance in home page or it is easy to navigate account balance. To demonstrate that we took screenshots form Bank of Punjab's mobile banking application for reference at figure 1(a,b).
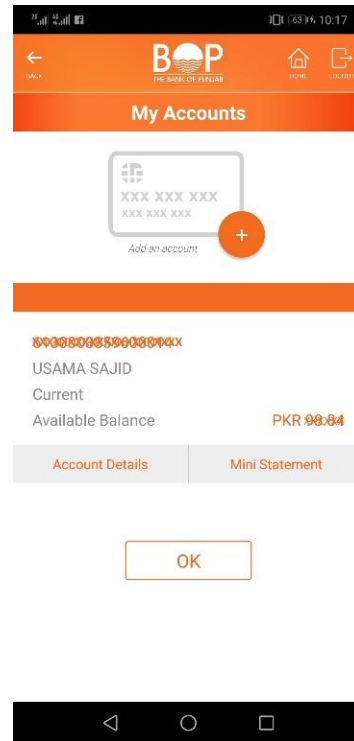

Fig. 1b. Balance Check

3.1.2 Bill Payments

This task was easy for those users who already were paying bills from their apps so they took not much time to complete this task. For those users who have never paid their bills through app, first needed to add their Bill before paying it. Adding bill details took some time for some users but almost all of them were successful only 5 persons were unsuccessful because they did not find from were to add bill details. This is because few apps have different screens to add bills so some users find difficulty to navigate (MIB app have this

Fig. 1a. Home page

• Balance checking

This task was the easiest task among all, almost every user was successful except one

problem). While most of the apps give facility to add bill details on same page if bill details not added. Below print screen Figure 2 shows add bill option have on same screen of bill payments while Figure 3 shows no options found in bill payment screen to add bill details.
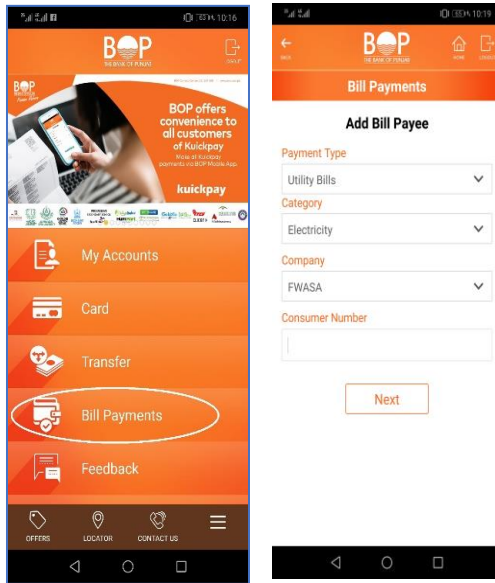

Fig.2. Bill payment and add bill

This task was also easy for those users who already were recharge their mobile balance from their apps so they took not much time to complete this task. For those users who have never recharge their mobile balance though app, first needed to add their network provider details to recharge their balance. Adding details took some time for some users but almost all of them successful only few were (6 persons) unsuccessful because they did not find from were to add bill details. This is because few apps have different screens to add bills so some users find difficulty to navigate (e.g. MIB app have this problem). While most of the apps give facility to add bill details on same page if bill details not added. Above print screen Figure 2 shows add bill option have on same screen of bill payments while Figure 3 shows no options found in bill payment screen to add bill details.
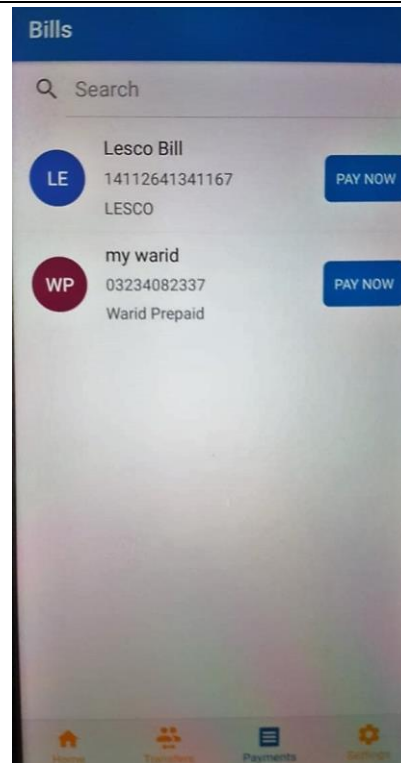

Fig.3. Absent of add bill option

3.1.4 Funds Transfer within bank

During Funds transfer tasks expert users were in their comfort zone, because they had done this so many times before while moderate or novice users find it a bit difficult to complete this task and took 6 to 10 minutes to complete this task. Through "Think Aloud" protocol we observed that most of the users find difficulty to check if their funds transferred successfully or not because of poor feedback from mobile apps. Few of the users also find difficult to navigate through the app to add beneficiary's details. Some novice users also complain about the name conventions used in some apps was not easy to understand for them. From Figure 4 we can see the process of funds transfer and add beneficiaries.
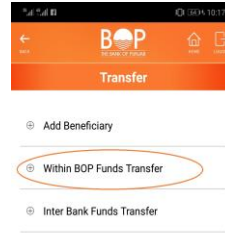
3.1.3 Mobile Top-ups

Fig.4. Fund transfer

3.1.5 Update Settings (e.g. change password)

This task was also easy for both users (expert or novice) because update setting is common operation/ term used in mobile app or web apps. Those users who are using any app or maintaining any account in any app or website were familiar to this task. We asked them to change their passwords most of the users were done it within 2 to 3 minutes only 2 were unsuccessful in doing this task.

3.1.6 Overall Success Rate

The following Table 4 shows the no of participants who have successfully performed each task on the mobile banking apps. Although majority tasks have been successfully completed within the expected completion period or approximately, some have been found hard [18]. Nielsen [10] defines the "percentage of tasks that the user completes correctly." This is the rate (i.e. success rate). For calculating the success rate Nielsen employs the following formula:

$$Success\ Rate = \frac{successful\ task + (partially\ successful\ task) * 0.5}{Total\ no\ of\ tasks}$$

TABLE 4. Success rate of tasks performed

Tasks	Gender	Age Class	Novice/ Experience	Successful	Partially Successful	Failed	Success Rate
Balance Checking				18	0	0	100 %
Bill Payments	13 Males and 5 Females	20 to above 35	Both	13	1	4	75 %
Mobile Top-ups				12	3	3	75 %
Funds Transfer				12	2	4	72%
Update Password				16	2	0	94%

Overall Success Rate		83.2%

3.1.7 Overall Relative Time based Efficiency

The overall relative time-based Efficiency of a product defined as the ratio of effective users' work time to all users' work time. Many experienced users had the least time to perform most of the tasks effectively while novice users took more time complete/ partially complete the task. Table 5 shows the user testing results for calculating overall relative table-based efficiency.

TABLE 5. Overall relative time-based efficiency

Tasks	Successful	Failed
Balance Checking	18	0
Bill Payments	13	5
Mobile Top-ups	12	6
Funds Transfer	12	6
Update Password	16	2
Overall Relative Time based Efficiency	**54.2%**	

TABLE 6. System usability score

Participant	Q1	Q 2	Q 3	Q 4	Q 5	Q6	Q 7	Q 8	SU Score
P1	4	5	2	2	3	4	4	2	**40.0**
P2	2	4	4	1	2	5	2	3	**32.5**
P3	3	2	3	3	2	3	2	3	**37.5**
P4	2	4	4	3	4	4	4	4	**37.5**
P5	3	3	2	2	2	2	2	3	**37.5**
P6	5	4	4	4	3	2	3	5	**40.0**
P7	1	3	3	3	1	2	3	5	**27.5**
P8	5	3	2	2	3	4	5	5	**42.5**
P9	5	2	2	3	3	2	5	5	**47.5**
P10	4	3	5	3	3	3	3	5	**42.5**
Average									**38.5**

3.1.8 User Satisfaction by SUS

After user testing candidates filled SUS questionnaire which had 10 questions with Likert scale. From the results researchers have found that the overall average usability score is 38.5 which is below the satisfaction level [19] [20]. Table 6 shows the System usability score in detail of each participant.

3.1.9 Heuristic Evaluation Results

For the m-banking apps, the researcher has established a usability checklist for heuristic evaluation. Table 7 shows that the ratio of major error highlighted by expert evaluators is 7%, minor error's ratio is 40% and cosmetic error were 54%.

TABLE 7. Heuristic evaluation results

Problem Type	Cosmetic	Minor	Major	Catastrophic	Total
Visibility of system status	4	5	2	0	11
Match between system and the real world	5	7	1	0	13
User control and freedom	4	4	0	0	8
Consistency and standards	7	4	1	0	12
Error prevention	6	5	1	0	12
Recognition rather than recall	4	3	0	0	7
Flexibility and efficiency of use	5	2	0	0	7
Aesthetic and minimalist design	3	2	0	0	5
Helps users recognize, diagnose, and recover from errors	6	3	0	0	9
Help and documentation	5	2	0	0	7
No of problems discovered	49	37	5	0	
Percentage of problems discovered	54%	40%	6%	0%	91

4. Discussions and recommendations

This segment shows users and expert's feedback on the challenges experienced during the two experiments, and provides a set of recommendations. The results of the test show that the novices had significantly more difficulty than the experienced users in executing certain tasks, but they were able to cope with that with time.

User satisfaction is among the main components of usability in order to enhance the usability of interactive mobile banking applications. When designing such a program, one should bear in mind not only for first-time users but also the retention of existing app users. As observed during User Testing, most of the users faced navigations problems, Feedback issues and naming convention's related issues. Few faced efficiency issues like response time.

Some suggestions for improving mobile banking applications are provided below.

- Use easy terminologies which are understandable for users.

- Enhance visibility of the status of transactions especially in case of transferring funds or paying bill.

- Provide help to novice users in case they mistake by proper feedback.

- Provide functionality of adding beneficiary details on same funds transfer page in case of the beneficiary not added.

- Improve navigation so that user is able to understand where he is and what to do next.

- Don't make interfaces a mess, keep it simple and provide only necessary information.

- FAQ and help button should be visible to the user.

- Title of each page should be displayed at the top.

5. Conclusion and Future work

The main objective of this study was to recognize and inspect the usability issues of the m-banking applications to enhance its

interaction with users. SUS survey was used to check the satisfaction level of a user which was below the average. Later, usability testing and heuristic evaluation showed that Mobile Banking apps are significantly harder for beginners than for experienced users. Based on the experiment conducted and expert opinions, recommendations are provided for UX/UI developers and designers. Banking sectors should follow the design principles of usability while designing apps in order to achieve best possible user satisfaction, effectiveness and efficiency of the system. Future work can be undertaken to evaluate the user interface of the m-banking application using combining multiple techniques, based on these integrated usability guidelines and their impact on the usability of m-banking applications. Low fidelity and high-fidelity prototypes can be developed to get better results. Multi-Criteria Decision analysis like AHP, Fuzzy AHP and TOPSIS techniques can also be used to prioritize m-banking usability issues in future work. Research on the design of m-banking applications for disabled or blind users may also be carried out in future work.

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