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Usability Enhancement through Heuristics: A Framework for Mobile Money Transfer Systems

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Abstract:
The widespread use of mobile technology has enabled the introduction of various mobile money services. Many factors contribute to the success of mobile money transfer systems, and usability measures the level of success. Usability heuristics principles developed by Nielsen, a pioneer in usability engineering, have existed and are popularly used to assess the usability of computer systems. However, in the wake of emerging new technologies such as mobile applications and mobile money transfer systems, there is a need for domain-specific heuristics. The purpose of the study is to investigate the usability of mobile money transfer systems and develop a usability heuristic framework that enhances Mobile Money Transfer Systems. The study covered mobile money transfer systems in Kenya. The research adopted a mixed method design that included the Design Science Research methodology and survey design. The Design Science Research process provided the structure for the study and the survey design guided the questionnaire administration. Data were obtained using questionnaires. The target population was Mobile Money Transfer System consumers in Nairobi County, Kenya. The data collected was analysed using both descriptive and factor analysis. A mobile money transfer system usability heuristics framework was developed using the findings. A sample of 396 was used, with a response rate of 81.1%. This framework was validated by mobile money transfer systems experts, who agreed that the developed framework can be applied in the real world with an average weighted mean of 4.55, allowing for further development. This research contributes to knowledge of usability heuristics required to evaluate mobile money transfer systems, reducing the development time and cost.

Keywords: *Mobile money, mobile money transfer system's usability, usability, usability heuristics, usability heuristics framework*

1. Introduction

A high growth rate in mobile subscriptions indicates a high demand for mobile services. High growth of mobile money financial innovation is a mobile service that serves as a powerful tool for economic growth and promoting social welfare. Kenya is the second largest market for mobile money in Africa. The development of applications has evolved with the introduction of mobile applications. However, usability engineering principles have not changed much to support the changing environment of emerging technologies. Due to technological improvements, mobile money consumers are now aware of their system usage needs and demand quality. Usability is an essential component of system quality.

The popular Nielsen usability heuristics have been used to assess computer systems usability in general. However, with the fast-changing technology and development of new systems, domain-specific heuristics will do better in enhancing the usability of the system in context. Mobile money services have been developed to meet the needs of the consumers. In Kenya, mobile money has included the unbanked, enabling them to access, send, save and acquire loans at their convenience. Despite the rapid growth of mobile money in Kenya, improvement in the quality of the system is required as consumer needs increase. Usability heuristics specific to mobile money can enhance mobile money systems and thus retain consumers.

This study uses data findings from a factor analysis of consumer data and applies the parameters to develop a usability framework for Mobile Money Transfer Systems (MMTS) design. This enables MMTS developers. Trainers and researchers apply mobile money-specific heuristics in development, training and research, respectively.

1.1. Problem Statement

It is clear from the high growth rate in mobile subscriptions that the demand for mobile services is plenty. The development of applications has evolved with the introduction of mobile applications. Applications are now available for use by mobile devices, creating a new environment that changes as the user moves around and is applied through a smaller screen than the conventional systems. Consumers of mobile money services demand an efficient and effective environment, which is growing as awareness of their system needs increases. However, usability engineering principles have not changed much to support the changing environment. There is a need for system developers to apply specific heuristics to mobile applications and specific ones to mobile money transfer systems. System developers, Human Computer Interaction (HCI) practitioners and trainers have continued to work with the traditional usability principles, one being the popular Nielsen heuristics and evaluation method (Nielsen, 2020).

Therefore, this study analyses the usability of mobile money transfer systems and attempts to identify domain-specific heuristics that will enhance the usability of mobile money services. It contributes to the usability knowledge of heuristics specific to the domain of mobile money systems. These domain-specific heuristics that enhance usability can help reduce the cost of usability evaluation and improve the mobile money consumers' experience. Overall, more knowledge on evaluating the usability of mobile money transfer systems has been provided by the study and is useful to researchers, system developers, HCI practitioners, and trainers.

2. Literature Survey

2.1. Mobile Money

Mobile money can be defined as money stored using the Subscriber Identity Module (SIM) with the mobile phone as an identity instead of an account number in conventional banking. One of the services that is recognized as a major need to boost the socio and economic needs of a developing nation such as Kenya is mobile money. Kenya hosts a number of service providers of mobile money, making her a global leader in the usage of mobile money transfer services" (Njuguna, 2018). The three (3) major mobile money transfer platforms in Kenya are Safaricom M-PESA AIRTEL MONEY and Telkom Tkash.

2.2. Usability Heuristics for Mobile Money

Usability is a fundamental measure of how users operate the product to achieve their goals and is essential in making systems easy to use and easy to learn (Al-Dossari, 2017). Usability, in the context of mobile money, refers to the ease with which users can understand, navigate, and successfully perform financial transactions using mobile phone codes. The basis of usability heuristics is proposed by Jacob Nielsen, which presents a formal way of enhancing usability in computerised systems. Nielsen stated ten (10) usability heuristics that can be described as: state of the system is visible, comparison of the system and the real world, user discretion and liberty, uniformity and standards, avoiding errors, recognition as opposed to recall, versatility and effectiveness, minimalist and attractive design, assist users in identifying, analyzing, and fixing issues, assistance and documentation guidance.

Usability heuristics for mobile applications have gained interest with the growing usage and application of mobile systems. Traditional usability methods cannot readily evaluate native smartphone applications as they do not consider applications for small screens or environments far less constant than desktop applications (Joyce & Lilley, 2014). A study to analyse the most used set of usability heuristics for usability evaluation for mobile devices by applying a systematic mapping of the related literature recognized that the traditional set of heuristics by Nielsen (2020) is still widely used. However, proposals for new heuristics for mobile interfaces have grown substantially (Salgado & Freire, 2014). Difficulties posed by the special traits and features of mobile devices, such as their portability, small screens, low resolution, finite amounts of processing power and memory, and data entry techniques, indicate a requirement for additional usability heuristics to fit mobile applications (Thitichaimongkhol & Senivongse, 2016).

2.3. Usability Frameworks and Development

Usability frameworks provide a guideline on usability principles and the context of the application. Five (5) quality components encompass usability: learnability, efficiency, memorability, error handling and user satisfaction (Dourado & Canedo, 2018). Working within this framework and in response to the study question on what heuristics are employed in mobile applications to assess product quality, thirteen (13) heuristics relevant to mobile interfaces were identified as follows: "visibility of system status," "user control and freedom," "consistency and standards," "error prevention," "minimize user memory load," "customization and shortcuts," "efficiency of use and performance," "aesthetic and minimalist design," "helping users recognize, diagnose and recover from errors," "help and documentation," "pleasant and respectful interaction with the user," and "privacy" (Dourado & Canedo, 2018).

A study on methods to identify new usability heuristics defined the process in six (6) steps. Step 1 is exploratory that investigates new applications in need of new usability heuristics. Step 2 is descriptive that revisits the definition of usability and its attributes in the context of the applications under consideration. Step 3 is correlational, where Nielsen's 10 well-known and widely utilized usability heuristics are employed as a foundation for this step 3 if the literature does not supply any specific and/or related heuristics. Step 4 is explicative that involves utilizing a template to specify the proposed set of heuristics. Step 5 is validation, which involves comparing new heuristics to established heuristics through heuristic assessments on particular cases. Lastly, step 6 is a refinement that is based on the feedback from the validation stage and may create a specific usability checklist that explains usability heuristics and facilitates heuristic evaluations. (Rusu et al., 2011).

The research approach of another study involved a number of processes in creating a new framework for usability criteria. The order of the processes is summarized as follows:

- Review of the literature and data gathering,
- Heuristic valuation using Nielsen's heuristics,
- A hierarchical analysis of data from different level of consumers leading to elimination of some data or development of sub heuristics,
- A release of initial version of usability heuristics,
- Determine the heuristics order of importance,
- Developing a new framework for usability heuristics,
- Validation of the framework (Benaida, 2023).

A study of Venmo mobile payment services suggests enhancing existing structures that users are familiar with rather than introducing entirely new systems when assessing usability for specific systems (Le, 2019). These reviews are direct research towards applying the use of existing usability heuristics by restructuring their suitability to assess and enhance the usability of the mobile money transfer system for consumers in Kenya (Lundmark & Lundgren, 2018).

3. Methodology

The study's approach involved a number of processes in creating a new framework for usability heuristics for mobile money. It applied the Design Science Research (DSR) and survey design. The DSR provided steps that provided the structure of the study. This structure fits in well with the development of a usability framework approach consisting of six (6) stages of exploratory, descriptive, correlational, explicative, validation and refinement applied by (Rusu et al., 2011). The DSR step 1, the initial problem awareness step, comprised exploratory and descriptive stages. DSR step 2, the suggestion stage, was aligned with the correlational stage. The DSR step 3, the development step, is aligned with the explicative stage. The DSR step 4 is the evaluation that complements the validation stage. The DSR step 5 conclusion step is aligned with the refinement stage. These steps, from the first to the last, can be applied iteratively.

Purposive sampling was used to select Nairobi County in Kenya. The target population was the consumers of mobile money services who engage in mobile money transfers. The sample size was statistically computed from the selected population using Taro Yamane's (1967) formula, which is a simplified formula for proportion (Adam, 2020). The study employed a confidence level of 95% and an error margin of 0.05 using a target population of 35156. A sample of 396 was selected and the survey design involved collecting information from respondents using self-administered structured questionnaires. The study employed face validity and content validity with an agreement of 96% validity and 0.0952 content validity ratio (CVR) value, respectively. The study focused on the internal consistency reliability measure of the Cronbach Alpha coefficient. A reliability test of the questionnaire items indicated a Cronbach's Alpha of .870.

4. Results and Discussion

The following findings and discussions provide the background to the development of the usability heuristic framework. The questionnaires were administered to the respondents and physically collected from 361 out of 396 respondents. The demographic data of the respondents are represented in table 1: Demographic Data – Personal Information. The response rate of completed questionnaires is 81.1%, which is good for this study.

Demographic Data – Personal Information		Percentage
Response Rate	Complete	81.1
	Missing	10.1
	Not returned	8.8
Gender	Male	52
	Female	48
Age of Respondents	25 and below	12.5
	26 and below 36	25.9
	36 and below 46	34.6
	46 and below 60	23.4
	60 and above	3.7
Language Use	English	90.3
	Swahili	9.7
Education Level	High school and below	30.8
	Middle level college	10.3
	University Graduate	26.8
	Student-undergraduate/	19.6

Table 1: Demographic Data-Personal Information
Source: Author, 2023

4.1. Mobile Money Transfer Systems Environment

The acquired data were subjected to a normality test to identify their type (parametric or non-parametric), which allowed the proper data analysis tools to be selected. Table 2: The normality Test depicts the findings.

	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	df	Sig.
MMTS Usability	.164	321	.003	.992	321	.000
a. Lilliefors Significance Correction						

Table 2: Normality Test

According to table 2: Normality Test, all of the constructs pass the Kolmogorov-Smirnov and Shapiro-Wilk tests with a significant value of less than 0.05. All the constructs are deemed significant by the test for normality with a P-value of 0.003 and 0.000, which are less than 0.05. This shows that the data are not normally distributed; hence, the study employed non-parametric data analysis tools.

Phone ownership was 100%, which implies that all the respondents owned a phone and were able to interact with MMTS. Table 3: Consumer information on the mobile money transfer environment provides a background of phone ownership, frequency of use, type of phone used, the average amount transferred and perceived benefits of using MMTS

Mobile Money Environment		Percentage
Phone Type	Smart phone	85
	Non-smartphone	15
Frequency of Use	Daily	50.2
	Weekly	19
	Monthly	16.2
	Rarely	14.6
Type of MMTS Platforms	MPESA	90
	Airtel Money	10
Average Amount Transferred	Ksh. 3000 and below	45.5
	Ksh 3001 to 10000	18.4
	Ksh. 10001 to 50000	17.4
	Ksh. 50001 to 100000	11.5
	Above Ksh.100000	7.2
Benefits of MMTS	Cost saving	31
	Time saving	30
	24 hour access	35
	Physical security	12

Table 3: Consumer Information on Mobile Money Transfer Environment
Source: Author, 2023

4.2. Mobile Money Transfer System's Usability Heuristics Assessment

The study sought to assess the usability of the MMTS. The study was guided by Neilsen's 10 popular (1994) and an additional three (3) from a study on mobile applications that were aligned to mobile interfaces. A total of thirteen (13) heuristics were assessed. They are:

- "Visibility of System Status,"
- "Match Between System and the Real World,"
- "User Control and Freedom,"
- "Consistency and Standards,"
- "Error prevention, minimize user memory load,"
- "Customization and shortcuts,"
- "Efficiency of use and performance,"
- "Aesthetic and minimalist design,"
- "Helping users recognize, diagnose and recover from errors,"
- "Help and documentation,"
- "Pleasant and respectful interaction with the user" and
- "Privacy."

The findings are presented as follows.

4.3. Suitability of Data for Factor Analysis

To determine if the sampled data is suitable for factor analysis, the Kaiser-Meyer-Olkin measure of sampling adequacy and Bartlett's test of sphericity were used. The results are summarized in table 4.

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.780
Bartlett's Test of Sphericity	Approx. Chi-Square	1846.831
	Df	55
	Sig.	.000

Table 4: KMO and Bartlett's Test

Table 4 – KMO and Bartlett's Test shows that the Kaiser-Meyer-Olkin Measure of Sampling Adequacy value is 0.780. This implies that the data is 78.0% suitable to be subjected to factor analysis. However, Bartlett's test of sphericity's significant (p) result is 0.000, which is less than 0.05. If the data have a significant Bartlett's test of sphericity value and a KMO value of more than 0.6, the data are sufficiently diverse, scalable, and can be subjected to factor analysis. Therefore, the data for the study can be sufficiently analyzed by factor analysis.

4.4. Factor Extraction

A usability checklist of items, which can be referred to as Seventy-four (74) different indications, was given to the respondents to rate on a scale from Strongly agree (1) to Strongly disagree (5). The responses were compiled and broken down using factor analysis to identify the principal components and their accompanying indicators. Using Principal Component Analysis method with Varimax rotation, results are presented in a Rotated Component Matrix that displays the mapping of the indicators into their respective components. Based on the analysis, the number of indicators mapped onto each component and the renaming of the component to a heuristic principle is indicated in table 5 - Summary of Indicator Loadings and Mapping onto Components.

Summary of Indicators Mapping onto Components and Renaming of Components

Component No	No of Indicators	The Respecitive Factor Loadings for the Indicators	Naming of Components According to how the Indicators Relate to MMTS
1	8	.801, .731, .900, .743, .689, .694, .630 ,.900	"visibility of the system status".
2	7	.563, .729, .754, .791, .976, .976, .909.	'Match Between System and the Real World'.
3	6	.909, .976, .975, .975, .942, .942.	'User Control and Freedom'.
4	6	.882, .866, .860, .851, .851, .809	'Consistency and Standards'
5	5	.928, .928, .873, .873, .792	'Error Prevention'.
6	6	.862, .862, .901, .901, .910, .910.	'Minimize User Memory Load'
7	4	.938, .938, .928, .928.	'Customization and Shortcuts'
8	5	.801, .752, .863, .877, .844	'Efficiency of Use and Performance'.
9	5	.961, .961, .895, .895, .961.	'Aesthetic and minimal design'.
10	5	.955, .955, .886, .886, .861	'Helping Users Recognize, Diagnose and Recover from Errors'.
11	6	.793, .845, .802, .802, .826, .744.	'Help and Documentation'
12	6	.827, .728, .839, .875, .858, .759.	'Pleasant and respectful interaction with the user'.
13	5	.894, .585, .650, .549, .900	'Privacy'.

Table 5: Summary of Indicator Loadings and Mapping onto Components
Source: Author, 2023

The respondents were asked to rate their level of agreement on the indicators for the 13 components. The results are indicated in table 6: Percentage on Level of Agreement for Indicators.

			LEVEL OF AGREEMENT ON THE INDICATORS FOR EACH COMPONENT					
No	Component name	No of Indicators	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	Percent Total
1	"visibility of the system status".	8	43.9	46.8	9.3			100
2	'Match Between System and the Real World'.	7	45.8	43.9	10.3			100
3	'User Control and Freedom'.	6	0.9	4.7	16.8	48.6	29	100
4	'Consistency and Standards'	6	29.3	47.7	17	4.4	1.6	100
5	'Error Prevention'.	5			15.9	48.9	35.2	100
6	'Minimize User Memory Load'	5	43.3	46.1	10.6			100
7	'Customization and Shortcuts'	4	33.6	56.4	10			100
8	'Efficiency of Use and Performance'.	5	44.2	50.8	5			100
9	'Aesthetic and minimal design'.	5	45.2	48.9	5.9			100
10	'Helping Users Recognize, Diagnose and Recover from Errors'.	6			16.8	42.7	40.5	100
11	'Help and Documentation'	6	34.9	51.1	10.3	3.7		100
12	'Pleasant and respectful interaction with the user'.	6	37.7	42.1	14.3	5.9		100
13	'Privacy'.	5			11.5	30.6	57.9	100

Table 6: Percentage of Level of Agreement for Indicators in Each Component
Source: Author, 2023

4.5. Development of Usability Heuristics Framework

The framework's constructs foundation was based on the study findings and the opinions of many respondents. Indicators that were convergent on different constructs were chosen based on their loading factors. The systematic creation of a usability heuristics framework for mobile money transfer systems was achieved by aiming to ascertain how the variables were loaded through communalities. Communality refers to the proportion of variance in an observed variable that is accounted for by the common factors extracted from the data. As a general principle, in order to be included in the analysis, variables typically need to have communalities greater than 0.5 (Hair et al., 2009).

A summary of the analysis is displayed in table 7: Communalities Summary.

Component No	No of Indicators	Component name (Heuristic)	Extraction values							
1	8	"visibility of the system status".	.307	.261	.430	.431	.207	.231	.356	.430
2	7	'Match Between System and the Real World'.	.179	.486	.474	.213	.464	.314	.257	
3	6	'User Control and Freedom'.	.736	.793	.618	.735	.812	.638		
4	6	'Consistency and Standards'	.772	.759	.723	.723	.798	.786		
5	5	'Error Prevention'.	.911	.942	.873	.875	.751			
6	6	'Minimize User Memory Load'	.854	.862	.703	.874	.902	.918		
7	4	'Customization and Shortcuts'	.238	.438	.428	.328				
8	5	'Efficiency of Use and Performance'.	.901	.792	.873	.637	.744			
9	5	'Aesthetic and minimal design'.	.261	.461	.395	.295	.261			
10	5	'Helping Users Recognize, Diagnose and Recover from Errors'.	.955	.955	.874	.883	.761			
11	6	'Help and Documentation'	.293	.245	.402	.302	.226	.444		
12	6	'Pleasant and respectful interaction with the user'.	.427	.328	.239	.175	.358	.259		
13	5	'Privacy'.	.717	.692	.716	.527	.877			

Table 7: Communalities Summary
Source: Author, 2023

Any component with an extraction value less than 0.5 in any one of its indicators was not to be included in the framework development, whereas those with extraction values 0.5 and above were included in the framework. The first, second, seventh, ninth, eleventh and twelfth components each had some indicators below 0.5 and, as a result, were not included in the framework.

The third component, named 'User control and freedom,' had six indicators with the loadings .909, .976, .975, .975, .942 and .942. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that this heuristic will be included in the framework development. Therefore, the user control and freedom heuristic has an average loading of (.909 + .976 + .975 + .975 + .942 +.942) /6 = .952

The fourth component, named 'Consistency and standards,' had six indicators with the loadings .882, .866, .860, .851, .851 and .809. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that this heuristic will be included in the framework development. Therefore, the consistency and standards heuristic has an average loading of (.882 + .866 + .860 + .851 +.851+.809) /6 = .853

The fifth component is named 'Error prevention.' It had five indicators with the loadings .928, .928, .873, .873 and .792. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that this heuristic will be included in the framework development. Therefore error prevention heuristic has the average loading of (.928 + .928 + .873 + .873 +.792)/5 = .879

The sixth component, named 'minimize user memory load,' had six indicators with the loadings .862, .862, .901, .901, .910, .910. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that this heuristic will be included in the framework development. Therefore, the minimized user memory load heuristic has the average loading of (.862 + .862 + .901 +.901 + .910 + .910) /6 = .891

The eighth component, named 'Efficiency of use and performance,' had five indicators with the loadings .801, .752, .863, .877 and .844. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that this heuristic will be included in the framework development. Therefore, the efficiency of use and performance of heuristic has an average loading of (.801 +.752 +.863 +.877+.844) /5 = .827

The tenth component, named 'Helping users recognize, diagnose and recover from errors,' had five indicators with the loadings .955, .955, .886, .886 and .861. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that this heuristic will be included in the framework development. Therefore, helping users recognize, diagnose and recover from errors heuristic has the average loading of (.955 +.955 +.886 +.886 + .861) /5 = .909

The thirteenth component, named 'privacy,' had five indicators with the loadings .894, .585, .650, .549 and .900. The survey on the communalities shows that these indicators have an extraction value of 0.5 and above. This implies that the heuristic will be included in the framework development. Therefore, privacy heuristic has the average loading of (.894 + .585 + .650 + .549 + .900) /5 = .716

4.6. The Framework Constructs

The findings in Table 5: Summary of Indicator Loadings and Mapping onto Components served as a reference for establishing the framework's parameters. The ideas were picked with care, representing the behaviours connected to the phenomenon. This was accomplished by employing factor analysis to examine and pinpoint the variables that loaded jointly on a certain component. The linked variables were grouped under theme notation to make them simpler to realize as the constructs and sub-constructs of the framework.

'Error prevention' with an average loading of .879 and 'helping users recognize, diagnose and recover from errors' with an average loading of .909 heuristics can be combined and renamed as 'Error handling' Construct.

The 'Privacy' heuristic with factor loading .716 can be termed a security construct.

The heuristic 'Minimize user memory load' with the factor loading of .891, which shows how the system is designed in such a way that the users are not supposed to memorize the actions when using MMT Systems, can be termed 'Memorability' Construct.

The 'efficiency of use and performance' heuristic with the factor loading of .827 can be termed 'optimization' Construct.

'User control and freedom' heuristic with the factor loading of .953, which allows the user to move from an unwanted state to a desired one and undo and redo their actions in a simple and intuitive way, can be termed as 'navigation,' Navigation Construct.

The 'consistency and standards' heuristic with a loading of .853 makes the different parts of the system that are related and must be similar have different designs or logic. This can be termed a 'Uniformity' Construct.

Based on the discussion in this section, the summary for the constructs and their respective loadings are summarized in table 8: Framework Constructs Loadings.

	Loading	Total loading	Weight
Error Handling		1.788	0.297
Error Prevention	0.879		
Helping users recognize, diagnose and recover from errors	0.909		
Security		0.716	0.119
Privacy	0.716		
Memorability		0.891	0.148
Minimize User Memory Load	0.891		
Optimization		0.827	0.137
Efficiency of use and Performance	0.827		
Navigation		0.953	0.158
User control and freedom	0.953		
Uniformity		0.853	0.142
Consistency and Standards	0.853		
Total		**6.028**	

Table 8: Framework Constructs Loadings
Source: Authors 2023

Table 8 – Framework Constructs Loadings highlights the constructs of the framework and its weight, which will contribute to the framework.

4.7. Mobile Money Transfer System's Usability Heuristics Framework (MMTSUHF)

Based on grounded theory, the Mobile Money Transfer System Usability Heuristics Framework (MMTSUHF) was created. The analysis discovered key constructs: Error Handling (.297) + Security (.119) + Memorability (.148) + Optimization (.137) + Navigation (.158) + Uniformity (.142) = 1.000.

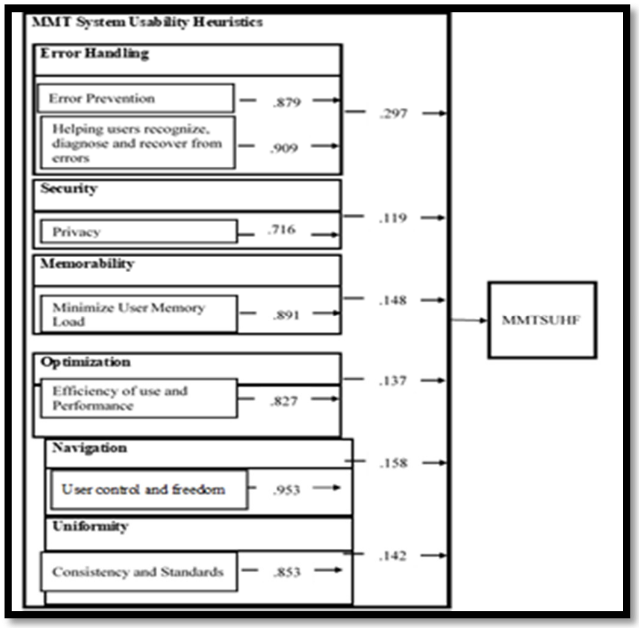

Figure 1: Mobile Money Transfer System Usability Heuristics Framework

Figure 1: Mobile Money Transfer System Usability Heuristics (MMTSUHF) can be used to enhance the Usability of Mobile Money Transfer Systems. The constructs weights: 'error handling' (.297), 'security' (.119), 'memorability' (.148), 'optimization' (.137), 'navigation' (.158) and 'uniformity' (.142) are important when considering the Usability of Mobile Money Transfer Systems. This implies that these features must integrate with their respective weights to enhance the usability of MMT Systems. These weight values represent the relative importance or influence in the overall function of the framework to produce the desired output or results.

4.8. Framework Validation

The study validated the developed framework focusing on operational validity, which determines the relationship between the framework and the real world. The validity of the developed framework was undertaken by a group of five (5) experts, as follows: two (2) mobile money transfer system expert users, two (2) mobile money transfer systems developers, and a mobile application development trainer. The combination was to ensure a balance between usability and subject matter experts. The experts were given validation items to rate their level of agreement from Strongly Agree with a weight of 5 to Strongly Disagree with a weight of 1. The results of the validation are highlighted in table 9 – Framework Validation Results.

Items	SA (5)	A (4)	N (3)	D (2)	SD (1)	Weighted Mean
The framework structure effectively integrates Usability Heuristics with the evaluation of Mobile Money Transfer System Usability, providing a sound and practical approach.	2	3	0	0	0	4.40
The parameters outlined in the framework demonstrate a clear and meaningful connection to real-world scenarios, enhancing its applicability and relevance.	4	1	0	0	0	4.80
The proposed framework exhibits a logical and appropriate alignment with the relevant attributes of real-world contexts, indicating its suitability for practical application.	2	2	1	0	0	4.20
The framework aggregation is suitable and relevant for the purpose it serves.	3	2	0	0	0	4.60
Overall, the framework is presented in a clear and easily comprehensible manner	4	1	0	0	0	4.80
The framework is comprehensive and covers all the necessary aspects	2	2	1	0	0	4.20

Items	SA (5)	A (4)	N (3)	D (2)	SD (1)	Weighted Mean
The logical arrangement and interconnection of all components in the framework result in a coherent and rational structure."	2	3	0	0	0	4.40
The framework has a well-defined structure and is easy to understand."	5	0	0	0	0	5.00
Average weighted mean						**4.55**

Table 9: Framework Validation Results

Table 9: Framework Validation Results depicts that based on the analysis, it can be concluded that experts have agreed that the developed framework can be applicable in the real world with an average weighted mean of 4.55. The weighted average of 4.55 over a maximum of 5 indicates that there is an opportunity for expansion and realignment or readjustment.

5. Conclusion

This study endeavoured to investigate and develop a usability heuristic framework that is domain-specific to Mobile Money Transfer Systems. The constructs of error handling, security, memorability, optimization, navigation, and uniformity of the Mobile Money Transfer Systems Usability Heuristics Framework (MMTSUHF) can be applied within the quality components of learnability, efficiency, satisfaction, errors, utility, memorability, and effectiveness context. This framework provides an evaluation guideline for mobile money system developers, human-computer interaction practitioners and trainers. Consumer retention is increased by a suitable system design. For future work, this framework can be put to the test with a higher number of mobile money systems and further validated. It is also a framework that should be constantly updated as new evidence and technology emerge in this field. Further research can take the framework to a richer level in various usability heuristics evaluation dimensions.

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