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Meta Model Investigation Empowered Mobile Apps Usability for Technology-Literate and Illiterate Users

[1]Joshan Keshavelal, [2]Iqra Farhain Nawaz, [3*]Khalid Hamid, [4]Muhammad Fahad, [5]Misbah Noor, [6]Muhammad Akram Mujahid, [7]Muhammad Ibrar, [8]Hafiz Abdul Basit Muhammad

Article Details

Joshan Keshavelal
Department of Computer Science, North American University Houston Texas
Lakhanijoshan12@gmail.com
Iqra Farhain Nawaz
Department of Computer and Mathematical Sciences, New Mexico Highlands University, Las Vegas, NM; Iqrafarhain@gmail.com
Khalid Hamid
Department of Computer Science and Information Technology, Superior University Lahore, Lahore, 54000, Pakistan; Corresponding Author Email: khalid6140@gmail.com
Muhammad Fahad
MS Information Technology, Washington University of Science and Technology, Alexandria VA; fahadmohmand101@gmail.com, Fahad.student@wust.edu
Misbah Noor
Faculty of Languages and Communication, Universiti Zainal Abidin (UniSZA), Malaysia; si4639@putra.unisza.edu.my
Muhammad Akram Mujahid
Department of Information Science, DSNT, University of Education, Lahore, 54000, Pakistan; akram.mujahid@ue.edu.pk
Muhammad Ibrar
Department of Computer and Mathematical Sciences New Mexico Highlands University, Las Vegas, NM; Mibrar@live.nmhu.edu
Hafiz Abdul Basit Muhammad
Department of Computer Science and Information Technology, Superior University Lahore, Lahore, 54000, Pakistan; basitbsse786@gmail.com

ABSTRACT

This study examines how well mobile apps work for both literate and illiterate users. With the ability to access information, services, and entertainment, mobile apps have become an indispensable component of daily life. However, not all users are the same, and depending on elements like literacy levels, the usefulness of mobile apps can vary dramatically. In order to address this problem, we carried out a thorough analysis of the prior work on the usability of mobile apps for both literate and illiterate users. While the study on the usability of mobile apps for literate users, our review of the literature revealed that there is a dearth of data on the usability of mobile apps for illiterate users. Existing research, however, indicates that creating mobile apps with simple and intuitive Existing research, however, points to ways to make mobile apps more accessible to illiterate users, including by using audiovisual aids, clear labelling, easy-to-find buttons, and simple, intuitive interfaces. We suggest a set of usability principles for developing mobile apps that are usable by both literate and illiterate users based on the findings of the literature research. This study attentions on important usability ideas such as user autonomy, cross-platform reliability, error anticipation, brief cognitive burden, adaptableness, and clear response. The study advances and confirms a usability model using both performing-based metrics and questionnaire responses, which are further examined using ANOVA. Additionally, it explores the relationship between usability heuristics and user collaboration results. With standardized questionnaires and presentation tests, information from clients with and without formal education was gathered. Findings indicate the importance of determining mobile application usability among diverse populations of users. Developers may create mobile applications that are helpful and usable for users with diverse levels of literacy by implementing user comments and results of prior study findings.

INTRODUCTION

Usability testing of a mobile app ensures that its intended users can navigate, utilize, and fully understand it and is an essential step in the development process. Several variables must be considered when those compare mobile applications for literate and illiterate users [1]. The primary objective of the usability measurement for educated users is to ensure that the software possesses a coherent and understandable user experience with clear buttons for simple navigation. The content must be hierarchical in relation to the needs of the user and easy to read as well as comprehend. Feedback must be informative, simple, and provide guidance on how to complete tasks effectively without wastage of time [2]. Moreover, the app must be well-smooth and also well-organized. During assessment, it is also important to take into account the possibility that text might not be the optimal way for transmitting data to those who are not good the audience. Icons, signs, and other visual form aids are used for expressing information; the app's design should make use of contrast and color to draw attention to important details. To identify any areas that might be difficult to use, the app should be tested with users who are not a highly educated Feedback should also be clear and simple to understand. In the end, tracking how well mobile applications work for both literate and illiterate users demand an extensive and methodical strategy that thinks about the particular needs of each group [3] [4].

Various approaches will be needed for evaluating the usability of mobile apps for literate and illiterate users because the wants and needs of two groups differ when it comes to interacting with technology. When monitoring how usable mobile apps are for these two groups, believe those factors:

FOR VISITORS

1. Content: Make sure the information is easy to understand and read, arranged in a clear hierarchy of information, and relevant to the user's needs.
2. Navigation: Check that the program functions consistent, straightforward identifying and navigation, easy-to-find controls, and a simple design.
3. Feedback: Offer obvious, informative feedback with messages to help the user end their work.

FOR THOSE WITHOUT LITERACY

1. Icons and Symbols: Since text may not always be the ideal way to convey information, use icons and symbols that are easily understood by everyone.
2. Color and Contrast: Make sure that key content stands out from the backdrop and uses colours and contrast to help express information.

3. Use audio and video to convey information since they may be easier to understand than text.
4. Feedback: Offer feedback that is straightforward and simple to comprehend and that explains what the user has to do next.

Both scenarios, it's crucial to test the app with individuals who are part of the intended audience and take their feedback into account while producing it. It might be easier for everyone to use or comprehend if the app has been evaluated with both educated and illiterate users. This will assist in identifying the software's areas which need improvements [5-8].

LITERATURE REVIEW

In the current age, mobile devices and applications for the lot from social networking to online banking, shopping, and education direct our daily lives. However, not all users are formed exactly undistinguishable, and based on variable star like literacy levels, the advantage of mobile apps may vary significantly. This review of the literature efforts to examine recent findings on the serviceability calculation of mobile apps for both literate and uneducated users, highlighting the meaning of creating mobile apps that are reachable to all users [9]. The prosperity of use of mobile apps by educated people has been the subject of common studies. Ahn et al. (2018), for occurrence, examined the usability of six mobile applications developed to encourage healthy eating. The survey found that some apps' small font sizes, mistaken classification, and not strong triangulation proved thought-provoking to use. For improved the usability of mobile apps for well-educated users, the authors directed designers to use larger, more projecting fonts, make navigation easier and make text cooler to read [10].

In a various examination, Kumar et al. (2019) estimated the usability of mobile apps for buying things online. The authors found that some applications had unclear steering and disorderly user interface that made it hard for users to finish tasks successfully. In order to make mobile apps simpler to utilize for well-educated users, the study emphasized the status of designing them with a simple user interface, right wrapping, and simple available panels.[11]. On other hand, tiny research is being done on how well mobile apps work for users who are uneducated. Nevertheless, some studies have examined the use of filmed aids and signs to boost the being nearby of mobile apps for uneducated users [12] [13]. Existing research, however, points to ways to make mobile apps more accessible to illiterate users, including by using audiovisual aids, clear labelling, easy-to-find buttons, and simple, intuitive interfaces. Developers may create mobile apps that are accessible and useful by everyone by incorporating user feedback and findings from previous research into the design process [14]. In the world, smartphones have evolved into more accessible and commonplace technology. According to their usage requirements, the user constantly brings them around. In 2021, there are expected to be 6.3 billion mobile phone users worldwide. Currently, Android and the iPhone are the most prominent operating systems, assuming a wide range of applications. The study discusses the development of adaptive features in all children's mobile phones. A great feature that makes it difficult for kids to use particular programmers and phone services is the kid's mode/baby mode. Information, visualization, and user interface are three types of adaptation, and adaptive smartphone characteristics have been acknowledged [15].

Globally, mobile technology is becoming crucial to children's survival; the national bureau and local schools have organized mobile trials for a variety of educational and academic motivations (Chiasson & Gutwin, 2005). Nearly all children in the US have access to a smartphone, with 93% of 6- to 9-year-olds living in homes with one. Additionally, 30% of 6- to 9-year-olds own smartphones, 20% own relaxing music players, and over 50% own mobile gaming devices. In parallel, ownership of mobile devices has increased significantly among kids ages 4 to 14 since 2005 (NPD Group, 2008). It is necessary to fully understand how youngsters connect and think in order to regale the children's inhabitants [16]. The carefully thought-out educational apps are incredibly beneficial for kids' studies. According to current research, a combined design approach and careful consideration of usability will result in enhanced mobile education. As children get older, their cognitive and motor skills diverge from those of men. Because they might not be virtual for this specific region, models and measuring models may not be appropriate to solicit to educational apps developed for children. In order to synthesize a set of usability guidelines for kid-friendly mobile educational apps, this study analyses the management process. As a result, a model with metrics and an estimation tool is created. The management usability model audit is covered in the next section [17].

In the United States, mobile technology has almost completely replaced desktop and laptop computers. Nearly two-thirds of native Americans now own a smartphone, and more than half of high society members do as well. Because this technology enables us to scale intercede, cover broad geographic regions, and impart telemetry in highly adapt ways based on the user's preference or attribute, smartphone automation can be very beneficial in the delivery of health interpose. Over the past five years, there has been a significant increase in the use of mobile technology as a strategy for interactive interposition additive to the delivery of healthcare and surveillance of health status [18]. Omnipresent programmers must be designed with the user's

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needs, preferences, and usage environment all taken into consideration in order to be useful. However, evaluating complex computing systems and their impact on users is extremely challenging because doing so necessitates investigating real users against a real-world backdrop. However, there hasn't been a consistent understanding of user exploitation and its ranking in HCI research. This may be due to a flaw in the definition of user incidence and its connection to usability problems. Inspired by recent advancements in supervised machine learning models [38] and precision and predictive strength demonstrated in corporate valuation models such as the Z-score [39] this study focus on the meta model investigation within mobile app meta-models to support both technology-literate and illiterate users. Additionally, new features in the field of user escapade research are escorted by future dynamic environments and adaptive mobile devices. The goal of the paper is to investigate how user experience may be used to check anything [19].

METHODOLOGY

Usability testing is to ascertain how well-read and illiterate users can comprehend and use various programmers to achieve their objectives. The degree to which users are satisfied with the method also plays a role. several educational, persuasion, gaming, and Islamic children's applications have passed several reviews to test the usability evaluation of portable programmers to increase their efficacy, constant quality, and user pleasure. For the purpose of testing the usefulness of various programs and observing how they were received by people of varied ages, a group was divided into 4 groups, each with 60 participants. It takes at least ten to fifteen people to submit trustworthy ratings for each activity in order to pinpoint any link usability issues [20] [21]. Both young adults with literacy skills and young adults without literacy skills participated in the group. Their participation levels ranged from novice to advanced. The children, ages 15 to 30, were chosen from a variety of educational institutions and were all enrolled in school. As part of the usability test, each participant was free to use both educational and leisurely programs. Each team member has to accomplish seven tasks. The highlights are arranged differently in the two programs [22] [23]. Participants have enough time to research before beginning the tasks; therefore, you should first introduce the projects. Equivalent amounts of time are allotted to each application to finish the tasks. The model used ANOVA for analysis with seven usability heuristics [24-26].

In order to assess and enhance the usability of software or digital products, usability heuristics are broad principles or guidelines that can be employed [27-29]. Seven frequently used usability principles are listed below. There are 7 attributes, the study selected for usability

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evaluation showing Fig. 1.

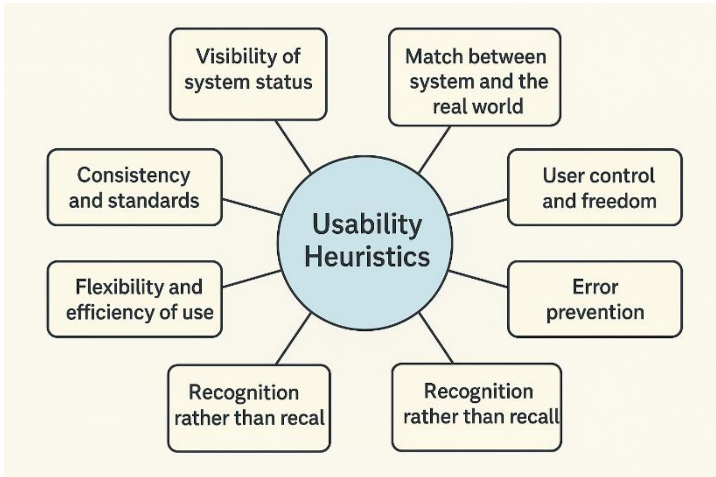

FIGURE 1: USABILITY MODEL

The attributes like System status visibility, Congruence between the system and the real world, User freedom and control, Standards and consistency, Error prevention, Recognition rather than recall, and Flexibility and effectiveness of use behave as guidelines [30-33]. These guidelines can help designers and developers make products that are user-friendly, effective, and enjoyable [34-36]. The Meta-Model is significant, which shows validation of the model [37].

RESULTS AND DISCUSSION

ANOVA FOR QUADRATIC MODEL

RESPONSE 1: LP USABILITY

Source	Sum of Squares	df	Mean Square	F-value	p-value	
Model	15.23	12	1.27	177.87	< 0.0001	significant
A-System Status Visibility	1.274E-07	1	1.274E-07	0.0000	0.9966	
B-Congruence	0.0000	1	0.0000	0.0000	1.0000	
C-User Freedom and Control	0.0002	1	0.0002	0.0266	0.8712	
D-Standards and Consistency	7.342E-06	1	7.342E-06	0.0010	0.9745	
E-Error Prevention	2.929E-06	1	2.929E-06	0.0004	0.9839	
F-Recognition rather than	0.0000	1	0.0000	0.0028	0.9581	

Recall					
G-Flexibility and Effectiveness of Use	1.072E-06	1	1.072E-06	0.0002	0.9903
AB	0.0000	1	0.0000	0.0000	1.0000
AC	7.745E-08	1	7.745E-08	0.0000	0.9974
AD	0.0001	1	0.0001	0.0106	0.9185
AE	7.359E-06	1	7.359E-06	0.0010	0.9745
AF	9.373E-07	1	9.373E-07	0.0001	0.9909
Pure Error	0.3424	48	0.0071		
Cor Total	15.57	60			

FIT STATISTICS

Std. Dev.	**0.0845**	R^2	**0.9780**
Mean	7.81	**Adjusted R^2**	0.9725
C.V. %	1.08	**Predicted R^2**	NA(1)
		Adeq Precision	57.8828

COEFFICIENTS IN TERMS OF CODED FACTORS

Factor	Coefficient Estimate	df	Standard Error	95% CI Low	95% CI High	VIF
Intercept	7.68	1	13.99	-20.45	35.82	
A-System Status Visibility	-0.2479	1	58.66	-118.19	117.69	3.453E+06
B-Congruence	7.535E-10	1	33.83	-68.01	68.01	39480.82
C-User Freedom and Control	-1.62	1	9.95	-21.63	18.38	80607.35
D-Standards and Consistency	0.6017	1	18.76	-37.11	38.31	3.439E+05
E-Error Prevention	0.7873	1	38.85	-77.33	78.90	9.621E+05
F-Recognition rather than Recall	1.13	1	21.39	-41.87	44.13	4.408E+05
G-Flexibility and Effectiveness of Use	0.1712	1	13.96	-27.91	28.25	54693.72

AB	4.228E-09	1	189.75	-381.52	381.52	3.829E+06
AC	0.7782	1	236.16	-474.05	475.60	6.972E+06
AD	-1.84	1	17.88	-37.79	34.11	42074.59
AE	4.58	1	142.45	-281.83	290.99	3.293E+06
AF	1.40	1	122.33	-244.55	247.35	9.287E+06

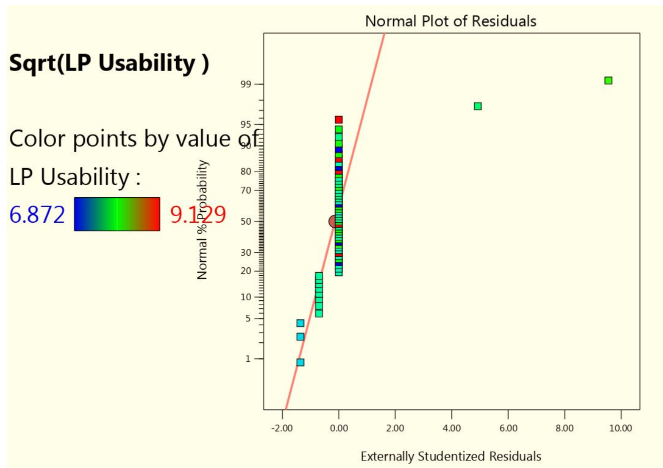

FIGURE 2: NORMAL PLOT OF DATA AND RESIDUALS

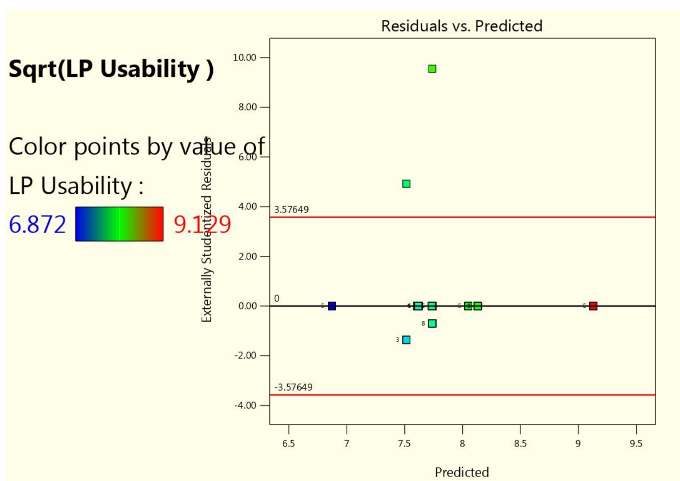

FIGURE 3: RESIDUALS AND PREDICTED DATA

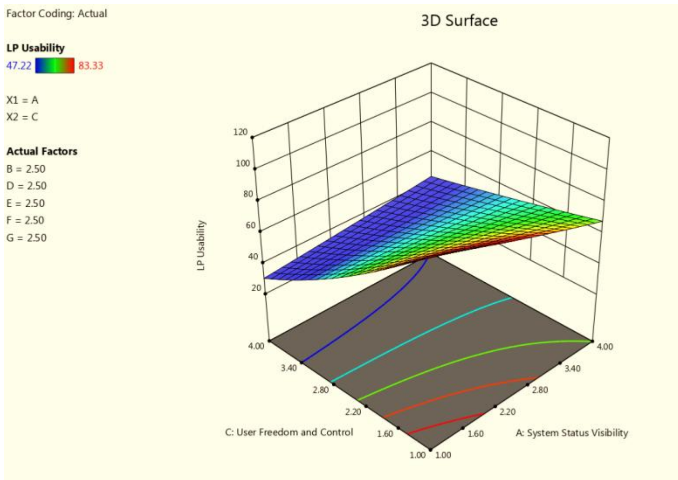

FIGURE 4: EFFECT OF USER FREEDOM AND CONTROL AND SYSTEM STATUS VISIBILITY ON USABILITY

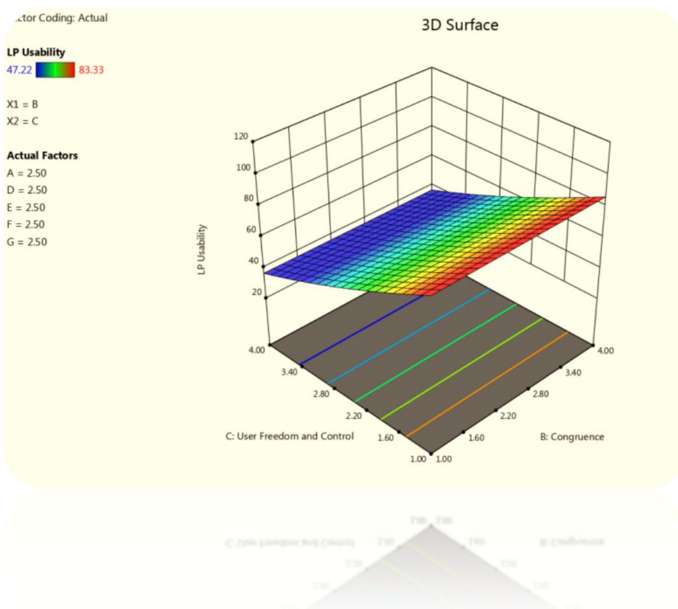

FIGURE 5: EFFECT OF CONGRUENCE AND USER FREEDOM AND CONTROL ON USABILITY

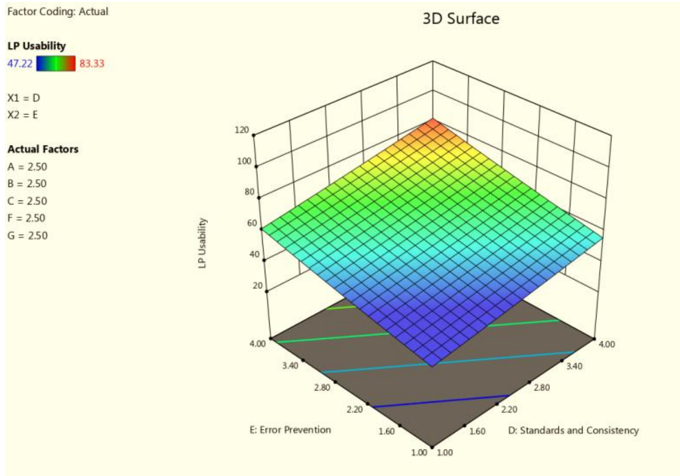

FIGURE 6: EFFECT OF STANDARD AND CONSISTENCY AND ERROR PREVENTION ON USABILITY

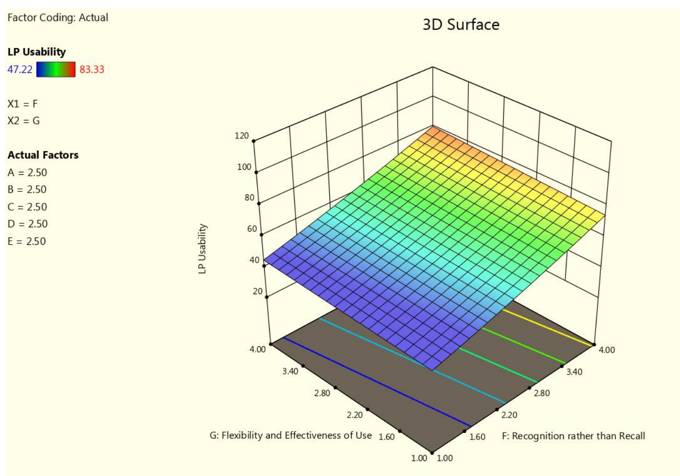

FIGURE 7: : EFFECT OF RECOGNITION RATHER THAN RECALL AND FLEXIBILITY AND EFFECTIVENESS OF USE ON USABILITY

ANALYSIS OF RESULTS

As seen from ANOVA based simulated graphs that error prevention, satisfaction, System status visibility, Congruence, Recognition rather than recall, Flexibility and effectiveness of use and Standards and consistency directly affect the usability of the app. These performance-based attributes directly proportional to the usability. Usability increases by the increase of these one. But on the other hands User freedom and control effect the usability of the app inversely. In the case, we understand that how much important to include the different heuristics of the usability when developing app. In future our plan to include more heuristics during developing and after that when evaluating the app.

The study model is significant and demonstrates that usability directly influences all variables; however, User freedom and control levels are substantially lower, at around 40% only. The simulation shows that Flexibility and effectiveness of use has a variable impact on usability. Usability can sometimes increase as Flexibility and effectiveness of use grows, and it can occasionally decrease as Flexibility and effectiveness of use increases. On the other side, a poor fit is inconsequential, which was necessary for the model to be significant. ANOVA is utilized to validate the study's usability model. This section of Tab. III displays the results of the usability assessment for literate and illiterate users. Users who are blind or visually challenged have had their task-specific efficacy calculated and compared. Both illiterate people and people with literacy can use the organization with no problems. It was clear that all literate and illiterate users had successfully completed Task 1. The effectiveness of task 2, which involves avoiding duplicate information, is up to 40% and 80% for literate and illiterate people, respectively. The results of the usability assessment for literate and illiterate users are presented in Tables 1 through Table 3 in this section. We evaluated and compared literate and illiterate users' task-based efficacy.

The results show that the presented usability attributes are directly related to the usability of the mobile apps for literate and illiterate people equally. As Figure 4 to Figure 7 show effect of different attributes on usability. There are some fluctuations in the gathered performance-based data due to literate and illiterate users together in future the study will be initiated separately for more specific results

DISCUSSION

The usability evaluation of mobile apps for literate and illiterate people presented in this paper sheds light on an important issue in the field of user experience design. With the increasing use of mobile apps in daily life, it is essential to ensure that they are accessible and usable by all users, regardless of their literacy levels. The paper presents a literature review that highlights the lack of research on the usability of mobile apps for illiterate users and proposes a set of usability guidelines that can help designers and developers create mobile apps that are accessible to all users. One of the main conclusions from the assessment of the research is that developing mobile apps with straightforward interfaces, obvious labelling, obvious controls, and the use of audiovisual aids and symbols can make them more usable for people who are illiterate. This implies that designers will focus on developing interfaces that are easy to use and understand and provide simple and direct feedback systems.

Seven heuristics widely used in the practice of user experience design form the basis of the proposed usability guidelines. These heuristics are to perceive the system's current state, the degree to which it matches the external world, freedom and control of the user, standardization and consistency, prevention of errors, recognition over recall, flexibility, and efficiency of use. These heuristics can be used by designers and developers as a useful guideline to ensure that their mobile apps can be accessed and utilized by everyone. The case study presented in the paper is particularly interesting since it shows how the proposed standards of usability can be employed in real applications. The usability of a mobile application that was developed to promote financial literacy among illiterates was determined based on the proposed usability principles. As per the research, the app managed to improve the level of financial literacy of financially illiterate users and was popular among users because they found it easy to use and understand.

In general, the user experience design field has been helped considerably by the usability evaluation of mobile applications for both literate and illiterate users provided in this research. For designers and developers aiming to make mobile apps that are accessible and useable by all users, the proposed usability principles and the case study can be helpful resources. By incorporating these guidelines into the design process, designers can create mobile apps that provide a positive user experience for all users, regardless of their literacy levels.

CONCLUSION

The ANOVA-based research discovers usability gaps in mobile apps and finds relationships between a variety of variables and usability. The Table demonstrates how the applied usability model is more meaningful and pertinent. In some cases, research has been done based on seven usability heuristics of the components of mobile apps. The fluctuation in data indicates the gap between users (like children, the literate, illiterate, and students for whom these applications are designed) and specialists (like IT specialists and developers). Because not all users can focus on tasks in the same ways, it is advisable to undertake sub-task-based usability testing of smartphones, separate evaluation of each category and their applications throughout each interaction. This study looked at how easily available mobile apps are on phones offered by suppliers. These apps were examined in the study in terms of usability factors. The usability heuristics receive a score between 47 and 83 based on how well literate people execute. However, when it came to the rating of usability, illiterate people received performance-based scores ranging from 35 to 80. But it doesn't always happen. The total usefulness of apps is 57% on average. The study used the Usability model to classify the Usability of mobile apps. It has been noticed that lower efficiency is caused by persons having trouble recognizing their own focus.

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