University of Sindh Journal of Information and Communication Technology (USJICT)
Volume 5, Issue 1, March 2021
ISSN-E: 2523-1235, ISSN-P: 2521-5582
Website: http://sujo.usindh.edu.pk/index.php/USJICT/

Usability Evaluation of E-Commerce Mobile Application

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Abstract: Mobile is not only reducing the distance between the people; it is also providing easiness for people to buy items remotely in just one click. In today's global village, different companies like Ali Express, eBay, Amazon, Daraz, Olx, Goto, and others have provided electronic commerce (e-commerce) platforms by offering facilities of mobile applications for users. During the current coronavirus (COVID-19) pandemic, the e-commerce landscape is changing rapidly, and on top of health concerns, brands across the globe are concerned about how COVID-19 will impact e-commerce. Most of the people all around the world using these e-commerce applications for grocery, daily usage products, or for clothing. Providing a better User Experience (UX) to the users, the user interface (UI) of e-commerce applications should be simple and easy to use for attracting users. But there are usability issues that developers cannot comprehend because these issues can only be identified with the help of users interacting with the UI. Therefore, to evaluate the usability and to find out the user's satisfaction System Usability Scale (SUS) is conducted on popular e-commerce mobile application including Ali Express, Daraz, and Goto. Sixty-Eight participants evaluated the interfaces from Pakistan. The results illustrated 71%, 69%, and 55% user satisfaction for Ali Express, Daraz, and Goto, respectively. Moreover, five usability experts evaluated the Goto e-commerce interface to identify the existing issues in the UI. The results revealed a path for designers to develop an efficient UI interface for e-commerce applications.

Keywords: E-Commerce, Usability Testing, Coronavirus, User Experience, User Interface, System Usability Scale

I. INTRODUCTION

The advancement in technology provides many facilities to the people and helps the business growth by selling and buying products online. Through these kinds of applications, products can reach from organization to customer, organization to organization, and from customer to customer. These e-commerce applications take the user to an entirely new level where they can buy and sell things [1, 2]. These applications can provide a great opportunity without any limitations. Thus, during the user interface (UI) development of e-commerce applications, the user needs should be incorporated to take advantage to the fullest. The growth of a business depends upon the satisfaction level of interaction with the UI for the users [3]. These mobile applications are growing very fast, but no standard is being used during the development of these applications.

John Brooke designed System Usability Scale (SUS) for measuring the satisfaction of the interfaces [1]. Moreover, Jakob Nielson [4] describes usability as the quality of the product and shows how easy the interface is to use. During the design process, usability can help in improving the ease of use of products [5]. The usability metrics which the ISO 9241 [6] standard defines is given below:

1) Effectiveness: How many tasks the user completed effectively.
2) Efficiency: How easily will users perform tasks, once they have learned the design?
3) Satisfaction: Does the user feel comfortable while using the system. In this study a combination SUS and heuristic evaluation are conducted for providing experts opinion on the UI with the least satisfaction level.

The preceding sections unfolds as Section II sheds light on the literature review. Section III highlights the impact of COVID-19 on e-commerce. Methodology is defined in Section IV and Section V illustrate detailed results followed by discussion and conclusions in Section VI and Section VII respectively.

II. LITERATURE REVIEW

A. *Internet and E-Commerce*

Now a day's internet has become one of the essential components in human life, and nothing can imagine working without the internet. The Internet is providing a medium to transfer communication between humans [7]. The websites developed during the past, only included static webpages. The users can only read text on the UI. But, with the advancement in technology consumers can get many services and seller can provide many services over the internet.

Previously, websites which users can see on the internet was just a plain text. The users can only read text and nothing more but now with the advancement in technology consumers

can get many services and seller can provide many services over the internet. One of the favorite activities of people over the internet is shopping. It is providing people the easiness that they can buy online anything, anytime remotely.

E-Commerce is buying and selling the products electronically over the internet [8]. E-Commerce business launched when the internet pioneered working commercially back in 1991, and amazon.com at that time was the first e-commerce website that providing thousands of products online.

B. E-Commerce Website and Mobile Applications

Many e-commerce websites and mobile applications are available today through which sellers are selling thousands of products online, and consumers are buying different products [9]. Amazon, Ali Express, Daraz, E-Bay, Goto, and many other companies are available which are providing online services for sellers and buyers.

Various studies have shed light on UI design for enhancing the usability of the m-commerce applications. Ahmed and Ibrahim [10] proposed methodology to enhance the user experience of m-commerce applications, the UI is to be given full consideration for gaining trust of the users. Similarly, Gul et. al [11] proves that design aesthetics is the mandatory usability factor to be included for enhancing the usability of m-commerce applications.

A mobile application that is easy to use is highly preferable by the user [12, 13]. After the e-commerce websites, all the companies are trying to develop mobile applications to increase the growth rate of their business. In this process of developing mobile applications, Mazhar and Devaraj are facing significant challenges [14, 15].

One of the significant challenges is trust, which is very hard to develop. Less trust means fewer purchases of goods and a low rate of popular brand participation in the business, which means a system fails. Many researchers have worked on how the trust of users can develop in mobile e-commerce applications. Aponte Vaga [16] did a study on building user trust in e-commerce applications and 200 users through a questionnaire.

Christine Roy [17] described usability, which is an important factor of trust-building in an e-commerce website and concluded that usability has a more significant impact on trust. They said that a good quality of interface builds an initial level of trust. In this research, 66 participants took part in the study. Users performed tasks to buy some books from 14 different websites, and all the websites have a different interface and collect data from all the participants.

Fogg [18] in a study recruited 2500 participants and asked them to evaluate two websites which are related to health and tried to find out how the people see the quality of the interface. Similarly, Rofiq and Mula [19] researched on e-commerce and measured the participants' trust.

Salzar [20] researched usability heuristic methods for mobile phones. The main reason for heuristic methods is the fast-growing rate of smart mobile in this world and also the interaction hypothesis, which states that UI for computers is not workable for smartphones. The author is trying to map the existing heuristic methods with ten Nielsen's heuristics [21].

Tago and Chandio [22] provided the theoretical framework which helps in the acceptance of mobile commerce. The factor which is discussed is the interface design of a mobile commerce application. The UI of the system should have three qualities in it. First, the screen design should have a prominent visual space for presenting information to the user. Second, the system language should be easy so that user interaction with the system can be made perfect. At the end for user navigation, a button should be provided so ease of use and ease of browsing can be made for users.

III. IMPACT OF COVID-19 ON E-COMMERCE

COVID-19 is a pandemic virus and affecting thousands of people daily. According to the report of Kim [23] this virus killed one hundred thousand people; the death rate is increasing rapidly. During this pandemic, the government has advised citizens to stay at home. This has affected the daily life activities of individuals. On the other hand, businesses have also been affected adversely. Zoom software company reports that its profit rate increases by up to 78% because of the online meetings through this software. Similarly, Google Meet states that its traffic increases by up to 60% due to COVID-19. This virus affects the economy of every country badly.

COVID-19 has also severely affected the e-commerce industry. Due to lockdown, to survive, and to stay away from crowded places, people started using e-commerce websites and mobile e-commerce applications to buy things online. The Google report [24] on online search phrases shown "online shopping" to be at the top trend.

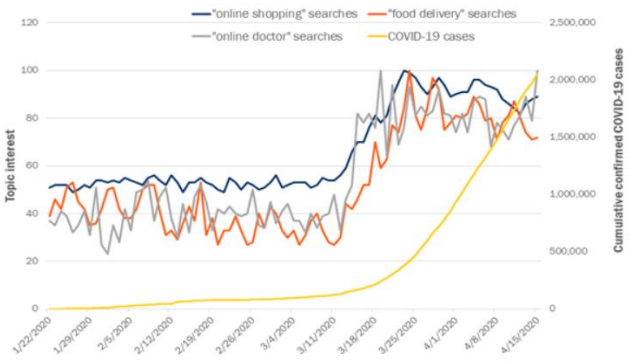


Figure. 1. Google Search Trend in COVID-19 [24]

In Fig. 1, the graph shows a blue line indicating "online shopping" searches, the orange line shows "food delivery" searches, the grey line shows "online doctor" searches, and the yellow line shows "COVID-19" cases. This graph covers the data from the end of the month, January to the mid of April. People are buying products online and using services that are

available online. Similarly, in Fig. 2 shows a report [25] of consumer behavior during the pandemic.

Figure. 2. Consumer Behavior [25]

Fig. 2 shows that during the pandemic, people tend to move towards online purchases increases rapidly instead of in-store purchasing. The impact of COVID-19 on the e-commerce industry shows growth. Therefore, in this situation, there is a need to provide easiness in the use of interface for the users. Sobia Saeed [26] states that the customer experience has direct impact on the customer intention to buy. Moreover, the they concludes that the UI is the factor for adoption of mobile e-commerce [27]. Therefore, in order to survey the customer experience and enhancing the mobile e-commerce usability testing is performed to find out errors in these three mobile applications, which we are being discussed in this paper to increase user satisfaction.

IV. METHODOLOGY

Experimental study design was conducted. In the study, e-commerce websites of AliExpress, Daraz, and Goto were analyzed. The usability of the interfaces was evaluated in two phases [28,29]: User Testing and Heuristic Evaluation. During the usability, testing participants were recruited with their consent to take part in the study. The participants were first briefed about the aim of the study. The users performed the target test task. The experiment was performed under the supervision of the mentor. After the direction of the tasks and performed as shown in Fig. 3 the users were to complete the SUS questionnaire [1] for measuring the satisfaction of the interface. Moreover, a heuristic evaluation was conducted using Neilson's Heuristic criteria to evaluate the interface by the experts. The experts evaluated the interface according to the severity rating of the Neilson's standards.

A. Experimental Design

During the first phase of the experiment, the users performed the tasks mentioned in Section B. After the performance of the tasks; the users completed the SUS questionnaire. All the participants filled the SUS questionnaire, and it contains ten questions related to the quality of mobile e-commerce applications.

1) Participants

The participants voluntarily participated in the study. Thirteen females and sixty-eight males, and all the participants are more than 18 years old. The participants have experience of interaction with the UI of mobile e-commerce applications between 2-5 years. Many of the participants frequently interact with mobile e-commerce applications often. The demographics of the participants are shown in table 1.

Table 1 Participants Demographics

Factor	Category	Frequency	Percentage
Gender	Male	68	83.9%
	Female	13	16%
Age	18-24	15	18.5%
	24-35	28	34.5%
	35-above	38	46.9%
Education	Intermediate or below	21	25.9%
	Bachelor	31	38.2%
	Master	29	35.8%
Internet frequency of use	1-2 hours	52	64.19%
	3-6 hours	16	19.7%
	Above	13	16%

B. Tasks

The participants performed the following five tasks to evaluate the usability of e-commerce applications.

- **Create an account:** Use the registration process to create an account and sign in into the application.
- **Adds funds:** The user adds money into the wallet by any method.
- **Search watch and add to cart:** Search out the product, add a product to cart, and continue shopping.
- **Find a technical solution to a problem:** Find some technical help on any topic.
- **Add payment method:** Check out the products and adds payment methods to place an order successfully.

1) Materials and Equipment

The session was conducted at the workplaces, universities, and the place of the participants. Both the android and iOS mobile applications were utilized.

2) Usability Questionnaire

SUS is a usability metric used during the experiment. It is based on 5 points Likert Scale. Participants gave their responses by providing values between 1 to 5 in which one value shows strongly disagree, and five value indicates strongly agree with the given question asked in the questionnaire.

3) Procedure

Before the start of the experiment, the users were briefed about the study. We gave all the participants a task related to the mobile e-commerce application to perform and then asked them to fill up the SUS questionnaire. A flow of our study that how all the procedure is conducted, as shown in Fig. 3 below.

Figure. 3. Experimental Procedure

C. System Usability Scale

After the performance of the tasks participants were directed to fill the SUS questionnaire. SUS is a 5-point Likert scale with ten questions. Each item value range from 0 to 4. For the odd items score contribution is scale value minus 1 whereas the even items are 5 minus the scale value selected by the user. All the items score is calculated and multiplied by 2.5 to obtain overall SUS score [1].

D. Heuristic Evaluation

The next phase of the study includes a heuristic evaluation of the UI of e-commerce applications. Jakob Nielson in 1994 defines the ten usability heuristics, which are given below [30]

- **Visibility of system status:** When a user uses a system, it should always inform the user through proper feedback the current state in which the user is present.
- **Match between system and the real world:** The system should use words or phrases through which the user is much more familiar rather than using the terms which are understandable by computer but not for humans.
- **User control and freedom:** Sometimes, users by mistakes press a button and go to an unwanted stage, so there should be a button by using user can quickly go back from he came like undo or redo functionality should be present.
- **Consistency and standards:** Users should not worry about the different style buttons, which means the same in functionality.
- **Help user recognition, diagnose, and recover from errors:** Error should be shown in a human-understandable language rather than computer codes like 404 error.
- **Error Prevention:** The system should warn the user when he is going to make some mistakes through a popup and prevent error occurring.
- **Recognition rather than recall:** The system should always show options when the user types something. The system should reduce the memory load of the human by providing suggestion about what user want.
- **Flexibility and minimalist design:** The system interface should support both novice and expert users. The UI design should be with fewer options to the novice users and more advanced options to the expert user on the type of user's demand.
- **Aesthetic and minimalist design:** The information which is showing to the user should be relevant to the user's need and avoid displaying the irrelevant details on the interface.
- **Help and documentation:** The best system is that whose users don't need any documentation or help while using or performing a particular task. Still, there will be some users who require help. Therefore, the system should provide its user help or documentation for the system.

The heuristic evaluation was conducted according to the Neilson's heuristic evaluation criteria and severity rating by Jakob Neilson [31]. The severity rating is shown in table 2. It is illustrating the severity of the identified issue. The issues are classified as 0-4, ranging from not at all usability issue to

catastrophic issues which need to be resolved on an urgent basis.

Table 2 Nelson's Severity Ranking Scale

Rating	Description
0	It does not seem a usability issue.
1	Cosmetic issue. Fix this problem when you have buffer time in your project timeline.
2	Minor issue. Fix this issue on low priority.
3	Major issue. Fix this issue on high priority.
4	Catastrophic issue. Fix this issue before product release.

1) Participants

Five expert evaluators took part in the study. The evaluators had an experience of using the e-commerce applications varying from 2-8 years. The expert participants evaluated the UI utilizing Neilson's Heuristic criteria. The demographics of the experts are illustrated in table 1.

Table 3 Participants Information

Sr.	Gender	Degree	Profession	Experience of using E-Commerce applications
1.	Male	BS Software Engineering.	Graphic Designer	5 years
2.	Male	BS Computer Science	Project Manager	8 years
3.	Male	BS Computer Science	Application Developer	6 years
4.	Female	MS Computer Science	Software Quality Assurance	4 years
5.	Female	BS Computer Science	Graphic Designer	2 years

V. RESULTS

A. Results of SUS

The results portrayed the evaluation of the three UI using the SUS questionnaire. All the participants evaluated the three UIs separately. Moreover, the usability issues in the Goto UI were identified. The SUS average rating lists, if the average of the system is > 67, then the system is Acceptable level. If its average is >50 and <67, it has a Marginal level, and if the average is <50, the system is not acceptable. The Fig. 4, it is concluded that Ali Express has a score 71, which is acceptable, Daraz has a score of 69, so it lies in the marginal level, and Goto has a score of 55, and it also lies in the marginal level.

B. Mean SUS Score Rating

All the participants completed the SUS questionnaire after using mobile e-commerce applications. The SUS average score of each e-commerce applications based on usability testing is shown in Fig. 4 where UI1 is Ali Express, UI2 is Daraz and UI3 is Goto.

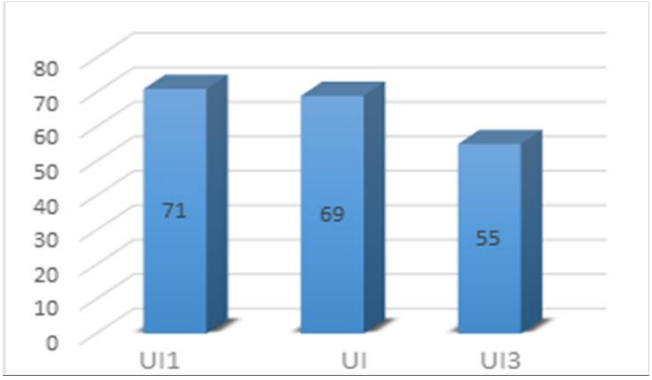


Figure. 4. Average SUS Score Adding Adjective Rating Scale

Bangor et al. [32] propose the adjective rating of SUS as shown in Fig. 5. It shows the acceptability scale of the system. In Fig. 6, we map the SUS result with the adjective rating scale for mobile e-commerce applications for better mapping of the results.

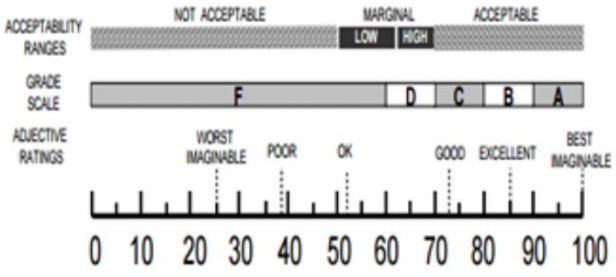


Figure. 5. Acceptability Scale [33]

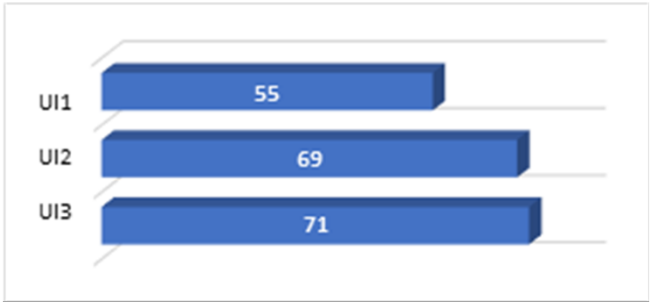


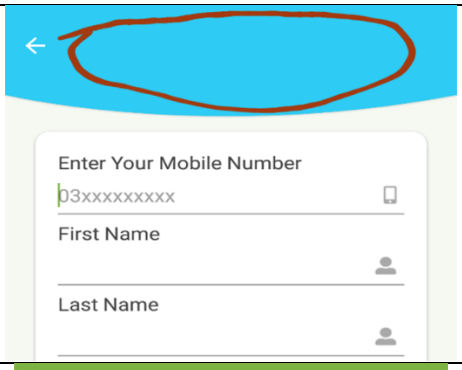
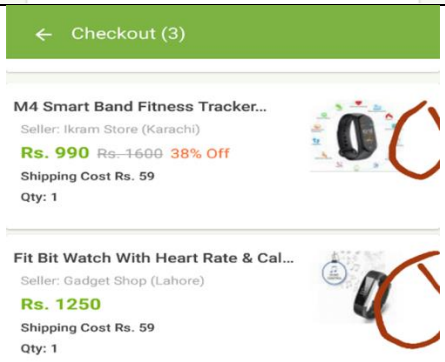
Figure. 6. Adjective Rating Scale Added to SUS

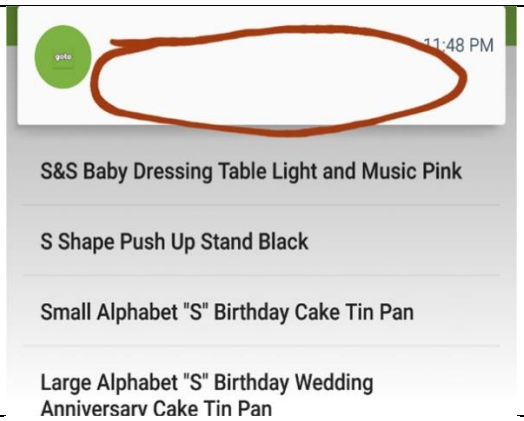
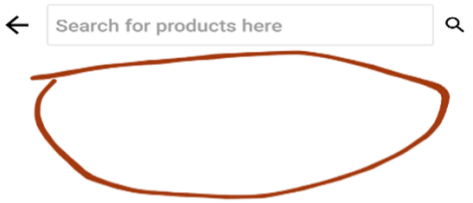
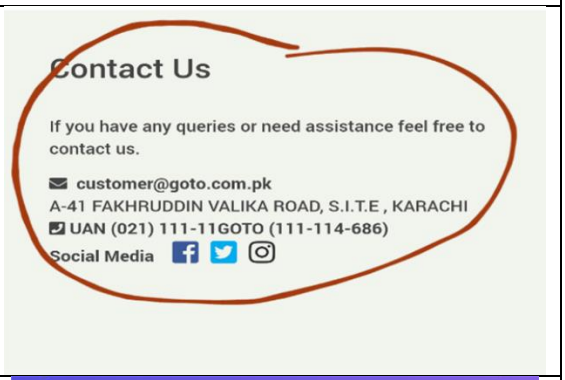
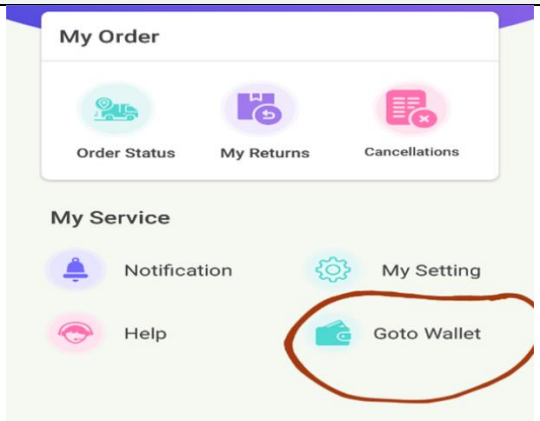
Heuristic evaluation according to severity rating of Neilson on Goto E-commerce UI is conducted. The results revealed 38 catastrophic issue existing in the UI as shown in table 4. Thus, these issues should be resolved at earliest to provide better UI for the users. Few of these usability issues identified by the experts along with possible recommendations are presented in table 5.

Table 4 Severity Rating of Errors according to Heuristic Evaluation

Heuristics	Goto E-Commerce Application					
	0	**1**	**2**	**3**	**4**	**Total Issues**
Visibility of system status	0	2	0	3	0	5
Match between the system and the real world	1	2	1	0	0	4
User control and freedom	0	1	0	1	2	4
Consistency and standards	0	2	1	2	0	5
Help users recognize, diagnose, recover from errors	0	0	2	0	1	3
Error prevention	0	0	0	1	3	4
Recognition rather than recall	1	2	0	0	0	3
Flexibility and efficiency of use	0	1	2	1	1	5
Aesthetic and minimalist design	0	2	1	0	0	3
Help and documentation	0	0	1	0	1	2
Total	2	12	8	8	8	38

Table 5 Evaluation Finding

Sr No.	Issue and Recommendation	Screen
1.	**Visibility of the system status** Issue: At the top bar, there is no header. Recommendation: Add the title on the top bar.	
2.	**User control and freedom** Issue: The item delete option is not available. Recommendation: There should be a button present on the right side of each item to delete it from the list.	

3.	**Visibility of issue** Issue: Notification description color is not different from the background, so the user cannot read the text. Recommendation: The text color of the notification description should be in contrast to the background color.	
4.	**Flexibility and efficiency of use** Issue: Keywords are not available for quick search. Recommendation: There should be some keywords for a quick search.	
5.	**Help and documentation** Issue: There is no FAQ available for the user's common problem. Recommendation: There should be an FAQ section where user can search out their common problem's section.	
6.	**Help user recognition, diagnose, and recover from a problem** Issue: Some options are not working correctly, and the user is not given any suggestions. Recommendation: For those options which are not working correctly, the user should be given a popup about suggestion.	

7.	**User control and freedom** Issue: If the user goes to some unwanted stage, the user cannot go to the home menu at one click. Recommendation: There should be a button for the home screen on all stages of the application so the user can go to the home screen easily.	

VI. DISCUSSION

The results show 71%, 69%, and 55% user satisfaction for Ali Express, Daraz, and Goto, respectively. Goto has the least satisfaction level aggregated through SUS score, therefore, the heuristic evaluation of Goto interface is conducted for providing suggestions to improve the usability of UI. The Goto m-commerce interface has a total of 38 issues identified by the experts among which few are highlighted in table 5. If the mentioned issues are resolved it can help to increase the usability of the application. The least SUS score of 55% of Goto is achieved due to the issues in all the Neilson's heuristics elaborated in Table 5.

VII. CONCLUSION

As we have seen from previous work related to the usability of mobile e-commerce applications many of the companies about application development or website development does not care about the usability due to which user faces many problems while using the system.

As the graph illustrated in figure 2 shows a rise in the search of e-commerce industry during the COVID-19. It is because people avoid going into markets and crowded areas, so they prefer to shop online by using different e-commerce websites or mobile applications, and there is a need to improve the usability of the mobile e-commerce application. So, in this paper, we did a usability test on different company's e-commerce mobile applications by applying usability techniques.

The study recruited eighty-one participants to evaluate the usability of e-commerce applications. The SUS evaluation results illustrate the satisfaction rating of the UI of the applications. Moreover, Neilson's heuristic evaluation is applied to identify the existing issues in the UI. The results are a roadmap for the designer to overcome the existing usability issues in the UI of e-commerce applications. The study can enhance the UX for the users of the e-commerce platform, helping the targeted industry to grow its business. The limitation of the study is that only participants recruited from Punjab, Pakistan, the study can be extended to other provinces as different cultural aspects.

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