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USER PERCEPTION USABILITY OF THE MALAYSIAN MOBILE TRIP PLANNER PLATFORM: A REVIEW STUDY

Hayder Naser Khraibet Al-Behadili[1*], Ku Ruhana Ku-Mahamud[2]

[1] Computer Science Department, Shatt Al Arab University College, Iraq
Email: haider872004@gmail.com
[2] School of Computing, Universiti Utara Malaysia, Malaysia
Email: ruhana@uum.edu.my
[*] Corresponding Author

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Abstract:

Tourism is important due to its benefits and role as a commercial activity that creates demand and growth in many industries. Tourism is vital not only in increasing economic activities but also in generating additional employment and revenue. Malaysia has increased its efforts in diversifying the economy and decreasing its dependence on exports by promoting increased tourism in the country. For this reason, the use of information technology in tourism has increased. Hence, mobile applications and applet tools play an important role among Internet users. This research reviews 24 standardised usability questionnaires in the literature for choosing the appropriate usability instrument. Then, this study investigated the usability measurement scales of the well-known mobile application, Malaysia Trip Planner, on the basis of Nielsen's usability principles. Therefore, this study could provide future research directions and recommendations on improving the attributes of such applications.

Keywords:

Information Technology; Trip Planner; Tourism; Mobile Application; Usability Testing instruments

Introduction

Numerous business reports have revealed that mobile technology has become an essential tool in improving tourism due to the natural increase in digital media consumption (e.g. mobile devices and tablets). Correspondingly, a Google study has indicated that many travellers use their smartphones during different stages of their travel for purposes of research, reservation, inspiration and experience. Additionally, the tools for searching travel information and

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purchasing and booking options in the tourism sector have changed from the home desktop to mobile devices. Consequently, tourism has come to a tipping point whilst mobile application commerce has begun to represent a major share in booking reservations worldwide. Trip planner applications are a popular category in the mobile app market. In the coming years, such applications will be the main travel platform. Thus, additional functions with access to information, co-creative services and interactivity must be provided to users.

Usability is a quality factor that assesses the level of ease and enjoyment of consumers when utilising the features of software to achieve satisfaction, effectiveness and efficiency (Hussain et al., 2018, 2017; Mortada & Hussain, 2019). In relation to the mobile tools of trip planner applications, previous studies have conducted investigations on increasing the business of individuals rather than the usability and adoption of such applications. In consideration of the limitations of previous studies, this study investigates the usability of tourism applications and provides recommendations on improving the quality features of software. The findings of this study are intended to help policy makers, designers and researchers for an improved understanding of the usability of such applications, provide a general rule in the design and promote the adoption of such software.

The remainder of this paper is structured as follows: A review of related literature is presented in Section 2. The evaluation method assessing the usability of the proposed calculator is discussed in Section 3. The experimental results of the proposed method are shown in Section 4. Lastly, recommendations on improving the usability and possible future research are provided in Section 5.

Review on Usability Instruments

The following factors have caused the emergence of many mobile applications in recent years: Firstly, laptops and desktop computers are not less portable than mobile devices. Secondly, the technology for logical bandwidth that is delivered to these mobile devices has grown efficiently, thus making mobile devices a helpful computing platform. Lastly, mobile users can customise their mobile platforms with mobile apps that meet their needs.

The number of applications downloaded via mobile applications is continuously increasing due to the millions of apps available on the iOS and Google Play platforms. Furthermore, the such tools are priced lower than those of personal computer software. Davis et al. (2003) developed a theoretical framework for this rapid adoption. This framework suggested that technology is adopted on the basis of its efficient usability and highly perceived usefulness, which is defined as understanding the ease of use in the model.

The improvement of mobile devices and their applications must be continued to understand their usability. Although many studies on the usability of smartphones have been conducted, majority of such investigations have focused on the operating system and hardware characteristics. Therefore, this study focused on the economy of single specialised apps (i.e. trip planner).

Several instruments have been used to measure the usability of smartphone applications, but finding a common instrument is the simplest way of consolidating the measurement. Famous instruments based on major digital libraries (Elsevier, Springer Link, ACM, Direct Science and IEEE Xplore) are presented as follows:

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Table 1: State-of-Art Usability Questionnaires

No	Reference	Standardized Usability Questionnaires	User Type	Items scales
1	(Davis, 1989)	Technology Acceptance Model questionnaire (TAM)	Computer software	7 points
2	(Chin et al., 1988)	The Questionnaire for User Interface Satisfaction (QUIS)	Computer software	10 points
3	(Kirakowski & Cierlik, 1998)	The Website Analysis and Measurement Inventory (AMI)	Any kind of websites	5 points
4	(Lewis, 1992)	Post-Study System Usability Questionnaire (PSSUQ)	Computer systems	7 points
5	(Kirakowski & Corbett, 1993)	The Software User Measurement Inventory (SUMI)	Software applications	3 points
6	(Brooke J., 1996)	The System Usability Scale (SUS)	Computer software	5 points
7	(Lewis, 1990)	The After-Scenario Questionnaire (ASQ)	Computer software	7 points
8	(Lewis et al., 2015)	Alternate Usability (AU)	Computer software	7 points
9	(Lin et al., 1997)	Purdue Usability Testing Questionnaire (PUTQ)	Information systems	7 points
10	(Lund, 2001)	The Usefulness, Satisfaction, and Ease of use Questionnaire (USEUQ)	Computer software	7 points
11	(Chiew & Salim, 2003)	Website Usability Evaluation tool (WEBUSE)	All types of websites	5 points
12	(McGee, 2003)	Usability Magnitude Estimation (UME)	Computer software	A rating of 1 to 100
13	(Ryu & Smith-jackson, 2005)	The Mobile Phone Usability Questionnaire (MPUQ)	All applications of mobile applications	7 points
14	(Lewis, 1995)	The Computer Software Usability Questionnaire (CSUQ)	Computer systems	7 points
15	(Albert & Dixon, 2013)	Expectation Ratings (ER)	Computer software	5 points
16	(Tedesco & Tullis, 2006)	Single Ease Question (SEQ)	Computer software	7 points
17	(Elling et al., 2007)	Website Evaluation Questionnaire (WEQ)	Governmental websites	5 points
18	(Sauro & Dumas, 2009)	Subjective Mental Effort Question (SMEQ)	Computer software	0 to 150 Graduated scale
19	(Yang et al., 2012)	Design-oriented Evaluation of Perceived usability (DEEP)	Information- web systems	5 points

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20	(Erdinç & Lewis, 2013)	Turkish-Computer System Usability Questionnaire (T-CSUQ)	Computer systems	7 points
21	(Lewis et al., 2013)	Usability Metric for User Experience-LITE (UMUX-LITE)	Computer software	7 points
22	(Finstad, 2010)	Usability Metric for User Experience (UMUX)	Computer software	7 points
23	(Sauro, 2015)	Standardized Universal Percentile Rank Questionnaire (SUPR-Q)	Interfaces of websites	11 points
24	(Polkosky, 2008)	Speech User Interface Service Quality questionnaire (SUISQ)	Voice response applications	5 points

On the basis of the selected characteristics, different methods have been proposed for the classification of questionnaires, as shown in Table 1. Yang, Linder and Bolchini (2012) classified the questionnaires into three types based on interface or system usage and named them universal, website and mobile usability questionnaires. Universal questionnaires are used in any type of electronic product. The following are examples of different applications that use universal questionnaires: TAM tests the usability of virtual learning systems and augmented reality applications (Milis, Wessa, Poelmans, Doom, & Bloemen, 2008; Chandrasekera, 2014); QUIS is used in educational software and vending machines (Akıllı, 2005; Naeini & Mostowfi, 2015); PSSUQ is utilised in research information systems; SUMI is applied to systems of product data management (Erik & Cisa, 1998); SUS is used in serious games (De Asmundis, 2014); ASQ is utilised in office application systems and nursing information (Lewis, 1990; Liaskos & Mantas, 2006); PUTQ is applied to recommender systems (Zins et al., 2004); USEUQ is utilised in robotic telepresence systems; UME is used in travel applications (Sauro & Dumas, 2009); CSUQ is found in virtual learning systems (Milis et al., 2008) and in information system (AL-Behadili et al., 2013); ER and SEQ are used in intranet site applications (Tedesco & Tullis, 2006); SMEQ can be found in travel application systems (Sauro & Dumas, 2009); T-CSUQ is applied to systems of web-based course management (Erdinç & Lewis, 2013); and UMUX-LITE and UMUX are used in e-learning applications (Borsci et al., 2015). Standardised usability questionnaires are used in websites (e.g. AMI, WEBUSE, WEQ, SUPR-Q and DEEP). The mobile phone usability questionnaire (MPUQ) is a type of mobile application questionnaire. The widely used Nielsen's principles as shown in Figure 1 were considered in testing the usability of Malaysia's mobile-based trip planner (Nielsen, 2012; Ramrecha et al., 2018). These principles are:

i. Learnability factor, this quality factor focusses in learnability level of end-users that utilize the Malaysian mobile trip planner for first time.
ii. Efficiency factor, this factor comes after the end-users have learned the mobile application. It is checking the execution time that end-users need to perform tasks on Malaysian mobile trip planner.
iii. Memorability factor, this factor checks how easy that user can remember the Malaysian mobile trip planner after a period of not using it.
iv. The error factor, this factor checks the quality throughout the system and how many errors present in the mobile application as well as how easy to recover from them.

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v. The final factor is satisfaction, this factor related to how easy end-users can utilize the Malaysian mobile trip planner application. Figure 1 below shows the main factors of Nielsen's usability principles.

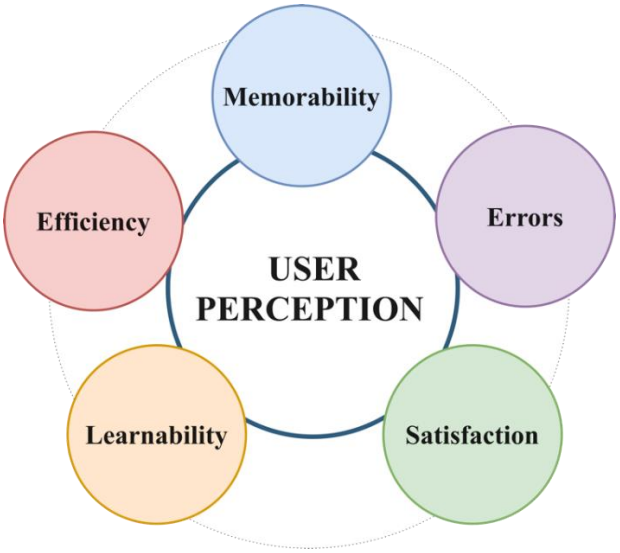

Figure 1: Nielsen's Usability Principles

Therefore, the MPUQ instrument was modified on the basis of these principles. Some items, which were irrelevant to this research, were removed (e.g. Is it easy to check missed calls?). The next section explains the research methodology of this study.

Method

This study was conducted at the University Utara Malaysia with 20 participants consisting of international postgraduate students of information technology. The participants were IT specialist and selected through random sampling in accordance with Faulkner (1998) standard number of users lies between 5 and 20 to solve usability problems (Faulkner, 2003; Gilbert et al., 2007). Our work focused on testing the usability of the trip planner platform and its main factors that contribute to the quality of mobile application usability.

The instrument used in our work is a survey questionnaire based on a revised version of the MPUQ. The questionnaire consists of two parts. The first part includes the general demographic information of the students. This basic information consists of gender and educational background. The second part is a 17-item questionnaire on the five factors of learnability, efficiency, memorability, errors and satisfaction, which are considered the most possible factors in the usability of mobile application. The students must choose their software level of usability for each factor using a five-point Likert scale ranging from strongly agree, agree, neutral, disagree and strongly disagree.

The validity and reliability of the instrument are important to ensure that the entire testing process meets all the research objectives. George and Mallery (2003) argued that items could have high reliability if they achieve a score of at least 0.8 (Cronbach's alpha) in the reliability statistics (analysis). Our research questionnaire (MPUQ) was used to indicate the usability of mobile phone applications. In all these academic works, MPUQ has demonstrated reliability

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and validity. For example, Ryu & Smith–Jackson (2005) conducted an investigation on mobile usability, and its Cronbach's alpha was 0.96, which demonstrates high internal reliability.

The Malaysian Trip Planner application can provide a single view of all your trips. The four main interfaces of this application are Explore, My Itinerary, What's on and Nearby Attractions, as shown in Figure 2. The Explore interface allows the user to explore the best places tourists can visit in Malaysia. The second interface allows tourists to plan their route or journey. The third interface shows Malaysian events in a given period of time. The last interface presents the nearby attractions and proposes activities within the vicinity.

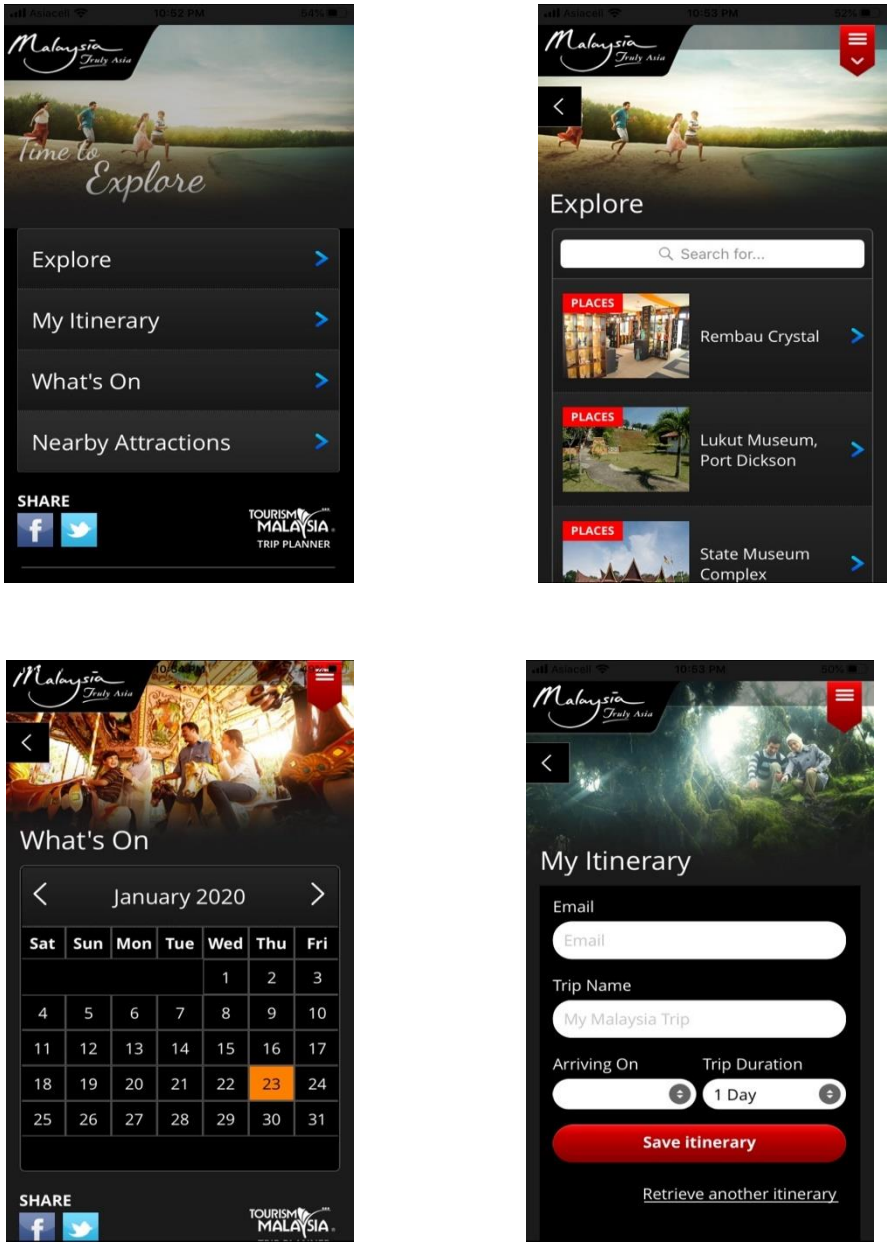

Figure 2: Key Screenshots of the Malaysia Trip Planner

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To test the usability of the platform, Nielsen's concept was considered due to its popularity. The modified instrument based on the five main factors (learnability, efficiency, memorability, errors and satisfaction) of Nielsen's principles are shown in Table 2. The following factors aimed to evaluate the ease of use of interfaces:

- Learnability is related to the level to which end-users feel.
- Efficiency entails how fast end-users can perform tasks.
- Memorability refers to how easy a system can be remembered by the user.
- Errors show the minimum number of errors in any application.
- Satisfaction involves how pleased a user is on the design of an application.

Table 2: The Modified Instrument Based on Nielsen's Principles

No	Attribute	Measured Items
1	Learnability	The application operates easy.
2		Easy to read characters on the screen.
3		Types of effort to interacting this application.
4		Easy control, operate and regulate this application.
5	Efficiency	Speed of the information display and response time.
6		Does the application occasionally stopped?
7		Data sufficiently consistent in this application.
8	Memorability	Data index well in this application.
9		Data items are short and clear.
10		The items highlight on the screen are helpful?
11	Errors	Typos mistakes are easy to edit.
12		This application is easy to operate with one hand.
13	Satisfaction	Is this application attractive and pleasing?
14		The application has attractive colour.
15		The application has attractive brightness.
16		Overall, comfortable and confident with this application.
17		Overall, satisfaction with the application.

The validity and reliability of the questionnaire are important to ensure that the entire experimental concept is established. Furthermore, the results obtained must meet all the research objectives. According to the literature, the instrument can have high reliability if they achieve a score of at least 0.8 (Cronbach's alpha) in the reliability statistics (analysis). Our revised questionnaire version MPUQ was checked, and the result of Cronbach's alpha for this study was 0.84, which demonstrates high internal reliability.

Results

The first section of the questionnaire includes the general demographic information of the participants. This basic information consists of gender and postgraduate degree. The total number of respondents in the study is 20. The demographic profile of the respondents is shown in Table 3.

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Table 3: Demographic Profile of Respondents

Gender of Participants	Type of participants	Total
Male	Master	4
	PhD	8
Female	Master	4
	PhD	4
Total		20

Table 4 presents the final statistical information results from the selected participants about the system usability. This part of the questionnaire aims to check the major factors affecting application usability. These factors are learnability, efficiency, memorability, errors and satisfaction, which are further classified in the following subsections to show the descriptive statistics of each factor. The subsections show the average usability level for each item.

Table 4: The Statistical Information About the System Usability Instrument

Questions	Total	Strongly Disagree	Disagree	Netutral	Agree	Strongly Agree
The application operates easy.	20	0%	5%	15%	65%	15%
Easy to read characters on the screen.	20	0%	0%	20%	55%	25%
Types of effort to interacting this application.	20	0%	5%	50%	40%	5%
Easy control, operate and regulate this application.	20	0%	5%	15%	60%	20%
Speed of the information display and response time.	20	0%	10%	40%	50%	0%
Does the application occasionally stop?	20	0%	5%	35%	55%	5%
Data sufficiently consistent in this application.	20	0%	5%	45%	50%	0%
Data index well in this application.	20	0%	5%	45%	45%	5%
Data items are short and clear.	20	0%	0%	50%	50%	0%
The items highlight on the screen are helpful?	20	0%	10%	30%	55%	5%
Typos mistakes are easy to edit.	20	0%	25%	25%	50%	0%
This application is easy to operate with one hand.	20	0%	0%	60%	35%	5%
Is this application attractive and pleasing?	20	0%	0%	40%	60%	0%
The application has attractive colour.	20	0%	0%	10%	90%	0%

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The application has attractive brightness.	20	0%	0%	40%	55%	5%
Overall, comfortable and confident with this application.	20	0%	0%	35%	45%	20%
Overall, satisfaction with the application.	20	0%	0%	15%	65%	20%

In the learnability factor, question 1 asks about how easy it is for the users to learn how to operate the application; the results in Table 5 show that the respondents agree to the ease of learning the application (Mean = 3.9 and Sd = 0.79). Question 2 asks about the characters on the screen; the results reveal that the respondents are satisfied (Mean = 4.05 and Sd = 1.00). In question 3, participants are asked about their feeling when interacting with the application; the results show that the respondents feel neutral (Mean = 3.45 and Sd = 0.93). In question 4, the respondents agree (Mean = 3.95 and Sd = 0.93) on the ease of operation and control of the application.

Table 5: Mean of the Learnability Factor

Measured Item	Mean Score
The application operates easy.	3.9
Easy to read characters on the screen.	4.05
Types of effort to interacting this application.	3.45
Easy control, operate and regulate this application.	3.95

The efficiency scale includes three items (5, 6 and 7) in the MPUQ questionnaire, as shown in Table 6. Question 5 asks about the response time and information display; the answers were neutral (Mean = 3.4 and Sd = 0.34). Table 6 lists the results of question 6. The findings also show that one of the participants could speak English better than the others to a certain degree. Table 6 presents the results of question 7, including the instances where the application stopped unexpectedly. The answers of the respondents to this question are neutral (Mean = 3.6 and Sd = 0.4). The results of question 7 demonstrate that the data display is sufficiently consistent. The dominantly neutral results are shown in Table 6 (Mean = 3.45 and Sd = 0.3).

Table 6: Mean of the Efficiency Factor

Measured Item	Mean Score
Speed of the information display and response time.	3.4
Does the application occasionally stopped?	3.6
Data sufficiently consistent in this application.	3.45

The memorability factor includes three items (8, 9 and 10). The answers of respondents to question 8 show the index data of the application. The results are listed in Table 7, and most of the participants agree with this question (Mean = 3.5 and Sd = 0.75). Question 9 asks whether the data items are kept short; majority of the respondents agree (Mean = 3.5 and Sd = 0.45). The answers to question 10 are shown in Table 7. Question 10 is related to whether the highlighting on the screen is helpful; majority of the respondents agree. Hence, the contributors agree (Mean = 3.55 and Sd = 0.64).

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Table 7: Mean of the Memorability Factor

Measured Item	Mean Score
Data index well in this application.	3.5
Data items are short and clear.	3.5
The items highlight on the screen are helpful?	3.55

The error factor of MPUQ has two items (11 and 12). In question 11, the participants are asked about the ease of correcting mistakes; the responses are neutral, as shown in Table 8 (Mean = 3.25 and Sd = 0.2). Item 12 asks about how the application operates; the responses show that the respondents agree (Mean = 3.45 and Sd = 1.13).

Table 8: Mean of the Errors Factor

Measured Item	Mean Score
Typos mistakes are easy to edit.	3.25
This application is easy to operate with one hand.	3.45

The last factor is satisfaction, which includes five items (13, 14, 15, 16 and 17). The results of question 13 show how attractive and pleasing the application is. The results show that majority of the respondents agree with the item (Mean = 3.6 and Sd = 0.75). Question 14 involves the attractiveness of the colour of the application. The results show that majority of the participants agree to this question (Mean = 3.9 and Sd = 0.85). In question 15, the participants are asked about the brightness of the application to which the respondents agree (Mean = 3.65 and Sd = 1.02). Question 16 determines the comfort and confidence of the user whilst operating the application. The responses show that the participants agree (Mean = 3.85 and Sd = 0.5). Question 17 determines the overall satisfaction of the user with the application. The results show that majority of respondents strongly agree (Mean = 4.05 and Sd = 0.25).

Table 9: Mean of the Satisfaction Factor

Measured Item	Mean Score
Is this application attractive and pleasing?	3.6
The application has attractive colour.	3.9
The application has attractive brightness.	3.65
Overall, comfortable and confident with this application.	3.85
Overall, satisfaction with the application.	4.05

The mean score for all the attributes of the usability quality factors is less than 4, which shows an overall result lying at the midpoint of the frequency distribution and a positive result for the usability of the proposed application. Amongst the factors, learnability and satisfaction obtain the highest mean scores because most of the participants successfully learned how to use the application with ease and were satisfied with the application. However, errors obtain the least score due to some errors that occurred during the usage of the application. Overall, the system obtains a usability of 3.65 in the proposed tool. Figure 3 illustrates the comparison of the different quality attributes.

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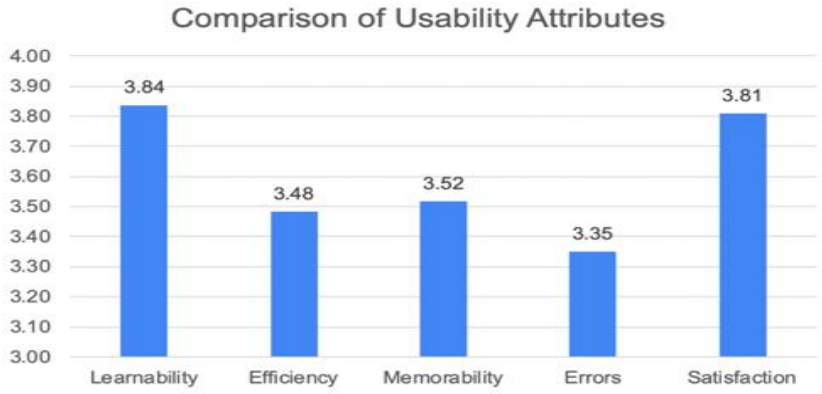

Figure 3: Comparison of the Usability Attributes

Therefore, regarding to T-test result of the usability factors among gender types. Table 10 display that students gender has no significant effect on all the three usability factors (learnability, efficiency and memorability). In addition, by using the t-test to indicates that there is a significant effect on two usability factors (errors and satisfaction), P-Value (20) = 0.048 and 0.037, respectively. It can be seen for the means that both males and females demonstrated a different level of system usability in errors and satisfaction factors, respectively.

Table 10: T-Test Result of Nielsen's Usability Factors with Respect to User's Type of Study

Factors	Gender	N	Mean	Std. Deviation	P-Value
Learnability	Female	8	3.813	0.260	0.418
	Male	12	3.854	0.322	
Efficiency	Female	8	3.292	0.144	0.052
	Male	12	3.611	0.173	
Memorability	Female	8	3.458	0.072	0.334
	Male	12	3.556	0.048	
Errors	Female	8	3.063	0.265	0.048
	Male	12	3.542	0.059	
Satisfaction	Female	8	3.650	0.105	0.037
	Male	12	3.917	0.25	

On the other hand, the results in Table 11 shows that there are no significant differences between user's type of study and the usability factors. The experimental result shows that there is no significant difference between PhD and Master students on all usability factors. It can be seen for the means that both PhD and Master demonstrated a rapprochement level in all usability factors.

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Table 11: T-Test Result of Nielsen's Usability Factors with Respect to User's Type of Study

Factors	Gender	N	Mean	Std. Deviation	P-Value
Learnability	Master	8	3.750	0.354	0.233
	PhD	12	3.896	0.239	
Efficiency	Master	8	3.292	0.072	0.050
	PhD	12	3.611	0.210	
Memorability	Master	8	3.542	0.191	0.427
	PhD	12	3.500	0.144	
Errors	Master	8	3.375	0.000	0.445
	PhD	12	3.333	0.236	
Satisfaction	Master	8	3.800	0.190	0.457
	PhD	12	3.817	0.246	

Conclusions

This research aimed to review standardised usability questionnaires for choosing the appropriate usability instrument. In this review, we find that the items of MPUQ questionnaires according to Nielsen's concept, suitable for mobile trip planner platform. The results based on items of MPUQ indicated that the application offered an enriching mobile experience to most of the participants in the study. Majority of the users perceived that the trip planner application satisfied their needs in terms of the five usability qualities evaluated in this study. In addition, this study indicates that male users make fewer errors than female users, while using the system. Therefore, the satisfaction evaluation of male is more than female users. However, some issues on findability demand attention and improvement in subsequent application updates. Lastly, with the development and emergence of new technologies, the design of usability instruments is required to deal with different types of mobile applications (e.g. health care, business and education).

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