# Antecedents to User Adoption of Interactive Mobile Maps

Azham Hussain[1], Emmanuel O.C. Mkpojiogu[1] and Fazillah Mohmad Kamal[2]
[1]*School of Computing, Universiti Utara Malaysia, 06010 Sintok, Malaysia.*
[2]*School of Quantitative Science, Universiti Utara Malaysia, 06010 Sintok, Malaysia.*
*azham.h@uum.edu.my*

***Abstract*—There are several studies on user adoption of new technologies. These studies attempt to determine the underlying antecedents or factors that spur users' adoption or acceptance of such technologies. The original Technology Acceptance Model (TAM) included perceived usefulness and perceived ease of use as determinants of users' adoption of information technologies. This model was later extended to include perceived enjoyment and other variables. However, in the context of interactive mobile maps, this model or its extensions have not been applied yet. This informed and underscored the objective of this investigation. This study is aimed at applying the TAM model's extension to the context of interactive mobile maps. This study therefore examines perceived usefulness, perceived ease of use and perceived enjoyment as antecedents to user adoption of interactive mobile maps using TAM model. The model was used to evaluate users' adoption of the technology (interactive mobile map) with perceived usefulness, perceived ease of use and perceived enjoyment as antecedents. A survey approach was used and the findings revealed that all the three factors used in this study explain well the variance in user adoption of interactive mobile maps. Perceived usefulness, perceived ease of use, and perceived enjoyment have significant positive effect on user adoption of interactive mobile maps. In sum, this study further confirms and validates the TAM model.**

***Index Terms*—Antecedents; Ease of Use; Enjoyment; Interactive Mobile Maps; Perceived Usefulness; User Adoption.**

## I. BACKGROUND

Interactive mobile maps offer some aids to users on how to locate where they are, currently and where they are going to, while also incorporating the users' mobility context. They are expected to provide usable client interfaces and lower the users' mistakes as well as their errors while locating places [1]. This is an integral part of interactive applications [2]. The usability of mobile maps implies reducing the discomfort and increasing the leisure users obtain while they find and search for their desired destinations. Kjeldskov et al. [3] argued that users use maps on mobile devices as a result of the utilities they obtain from them. The use of mobile devices for searching locations or places presents some challenges for users due to factors such as the screen size of phones and the up and down zooming on mobile maps. Mobile maps offer various benefits to users such as the provision of access to any map location in the world at any time while the users are mobile [4]. Several research and studies have been carried out on usability of mobile maps [5]. However, no study has been carried out in the context of interactive mobile maps to understand factors that drive or propel users' adoption of interactive mobile maps or their intention to use the technology. This study adopts the TAM model to assess the factors that influence users' adoption of interactive mobile maps. The study attempts to examine the impact or the effect of perceived usefulness, perceived ease of use and perceived enjoyment on users' adoption of interactive mobile maps.

### *A. Mobile Map*

Mobile map is application software that runs on a mobile device. It gathers geographic data to determine a user's location at a point in time [6]. Mobile map can also show users the locations of public services like hospital, police station, and emergency services. They can as well present the location of the user and the place he/she is searching by distance as well as the time it can take to move from the users' location to the destination that they want to go to. Mobile map has preferences which can be personalized and be adapted to the users' search and request and provide aid on what they are looking for on the map. The user can search for environmental issues and conditions such as surrounding weather, emergency services, traffic, shopping center and other places that they are interesting in. Searching on maps can give users exact information that they need or require, and also help them navigate to their points of interest, and provide them proximity notification, and location-related commercial services notification such us online payment possibilities [7]. The capacity of mobile maps to determine the present location of a user and to search on the maps to know the destination of both where the user is and where to go while the user is mobile, is the main objective of mobile maps. Mobile devices play vital role in our everyday's life. Users can be confident and assured to travel to anywhere they want without being to the location before in as much as the map is on their mobile device which can serve as direction to them to search and locate where they are going to [8].

Geospatial information in mobile maps play vital role in mobile maps. They assist the client to comprehend geospatial ideas, for example, introduction, bearings and distance [9-10]. The graphical interface of maps gives a more reasonable understanding of the environment, something that is significantly more troublesome when the interface is in printed or audible form. Mobile maps guide visualizations and keep graphical/ mapping interface clear, they also provide pleasure to the user, while giving them the nature of data that can fulfill

their quest, curiosities, necessities and desires. Usability issues on mobile maps arise due to the smallness of screen sizes of mobile devices that hampers visualization and the clarity of information [25-27, 30-35]. This makes the devices to have limited number of item or object that can appear on their screens. This affects the ability of maps on mobile to describe places and objects to users [7]. Finally, data exchange with the server is a challenge as this affects the continuously changing transmission factors that affect the quality and speed of communication [11].

## II. TAM Model

The Technology Acceptance Model (TAM) [18] provides a conceptual framework that is based on some theories in social psychology, such as, the theory of reasoned action (TRA) (Ajzen & Fishbein [28]), and the theory of planned behavior (TPB) [12]. On the foundation of these theories, TAM proposed a causal model to explain and predict the acceptance or adoption of a given information technology by potential users. The original TAM suggests that perceived usefulness and perceived ease of use are antecedents that have effect on user's attitude towards using a technology, which in turn determines their intention to use or to adopt it [13]. Furthermore, TAM also pointed out that perceived ease of use explains the variance in perceived usefulness. Prior research have validated the TAM framework [13-14], hence, TAM offers a good platform to assess users' adoption of interactive mobile maps. More so, TAM is the most widely applied model in user acceptance of technology studies when compared to other models like TPB [12] and UTAUT (unified theory of acceptance and usage of technology) [29]. The reason for this is the simplicity and ease of implementation of the model [14-15].

However, the shortcoming of TAM comes from the fact several vital factors were not included in the original model. This reveals why researchers often extend TAM by adding other factors that are relevant in different contexts and settings [14]. One of such extensions is the addition of perceived enjoyment by Davis et al. [16] as an antecedent to user adoption of information technology. They found that perceived pleasure has a significant impact on the users' adoption intention for a word processing program [16]. Further still, perceived ease of use influences perceived usefulness and perceived enjoyment [17]. Davis et al. [16], posits that perceived usefulness and perceived enjoyment have relative influence on intention to use and usage of information technology [16]. A positive interaction between perceived usefulness and perceived enjoyment was also observed [16]. However, these antecedents (perceived usefulness, perceived ease of use and perceived enjoyment) though used in other research contexts as antecedents to user adoption of information technology, have not been verified or applied in interactive mobile map context.

### A. Perceived Usefulness

Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" [18]. Perceived usefulness explains the user's recognition that the interactive mobile map innovation will improve their task performance in conveniently finding locations through their interaction with the devices' interface [18]. The user has a view of how valuable the innovation is in performing his or her tasks (i.e. mobile map's effectiveness) and how useful the mobile map is in reducing the time to get locations of where they are going to or where they are or getting the distance from a location to another location (i.e. mobile map's efficiency). This is coupled with their overall satisfaction about the ease of use of the application (i.e. mobile map's satisfaction or ease of use). From this backdrop, the following hypothesis is projected:

H1: Perceived usefulness has a positive effect on users' adoption of interactive mobile maps.

### B. Perceived Ease of Use

Davis [18] describes perceived ease of use as "the degree to which a person believes that using a particular system would be free of effort", that is, the extent that using a specific technology (such as, mobile map) would be free of physical and mental exertion. The user may accept that a given innovation (such as, mobile map) is helpful, but while using the mobile application, the user may find out that the innovation may be difficult to use. For instance, the object on mobile screen may be difficult to see. Ease of use is the user's impression of or perception about the measure of requirement needed to use a technology or the degree to which a user accepts that utilizing a specific innovation will be effortless and smooth [18]. Apart from Davis et al. [18], Zhu et al. [19] also included perceived ease of use as a determinant to the intention to use a mobile device. Following this background, the following hypothesis is proposed:

H2: Perceived ease of use has a positive effect on users' adoption of interactive mobile maps.

### C. Perceived Enjoyment

Enjoyment alludes to the degree to which the use of a technology (like mobile map) is seen to be enjoyable, pleasurable and fun [16]. It refers to the hedonic (visual) attractiveness, aesthetic beauty, perceived comfort, perceived pleasure, playfulness or fun derived from using a system or an interface. It is a motivation for users to use the innovation as it gives them joy to use it. A number of studies on perceived enjoyment [16, 20] have shown that users' happiness while using an application have great impact on their intention to use the application. Igbaria [20] found that pleasure or perceived enjoyment is related with the time of use. Moon and Kim [21] found that liveliness had an immense effect on the users' expectation to utilize information technology. User derived pleasure, entertainment and fun from the use of an application impacts on their adoption of the application. Hence the following hypothesis is formulated:

H3: Perceived enjoyment has a positive effect on user adoption of interactive mobile maps.

## III. Research Methodology

This study was conducted in Universiti Utara Malaysia. Judgmental sampling was used to select and enroll the study participants who have experience or who use or have been using mobile maps on their mobile device. To elicit the data used in the study, 80 questionnaires were distributed; but, only 65 copies (representing a response rate of 81.25%) were collected back from respondent. The shortfall in the collected

questionnaires was due to the time frame slated for the study and other constraints. SPSS IBM version 20 was used to analyze the demographics while smartPLZ version 2.0 was used to run the main analysis for the study.

## IV. RESULTS

The result of this study is presented in this section and includes the discussions on demographics, measurement model, and the structural model.

### *A. Demographics*

From the survey, 31% of respondents were male while 69% were female. The spread of the ages of participants is as follows: 20-30 (58%), 31-40 (40%), 41-50 (2%), 51 and above (0%). Thus, most of the participants were between the ages of 20-40, attesting and pointing to the age range of users that often and commonly use mobile maps. In addition to the demographic characteristics, the participants' distribution per apps used is as follows: Google Maps (69%), Waze (31%). Also, the participants' distribution based on the screen size of the participants' mobile device is as follows: small (15%), medium (62%) and large (23%).

### *B. Measurement Model*

The study measurement model was verified using confirmatory factor analysis so as to test the validity and reliability of the constructs. The model's convergent; discriminant and construct validity as well as its reliability were tested and confirmed.

#### *a. Convergent Validity*

Loadings and cross-loadings were verified to ascertain if items in a given construct used in the measure loaded higher in the construct more than they loaded on the other associated corresponding constructs in the measure. This verification is checked for each construct used in the measure. Convergent validity of the constructs was examined using factor loadings and average variance extracted (AVE) statistics. On the basis of the recommendation of Hair et al. [22], factor loadings greater than 0.50 were considered to be significant. All the factor loadings in this study were greater than 0.50 (see Tables 1 and 2). As shown in Table 2, the AVE for each construct exceeded the recommended level of 0.50. This implies that over 50% of the variances observed in the items were accounted for by the hypothesized constructs.

#### *b. Reliability*

Reliability is the measure of the internal consistency of the items in a construct or questionnaire. As can be seen in Table 2, the Cronbach alpha coefficient for perceived usefulness is 0.799, for perceived ease of use is 0.817, for perceived enjoyment is 0.862 and for user adoption is 0.824. Cronbach alpha values, 0.70 and above are considered good estimates of reliability of a construct and the internal consistency of items in the construct [23]. This also applies to the composite reliability (CR), the estimates are all above the recommended 0.70 [24]. These results show that the measures have good reliability.

Table 1
Factor Loadings

| Items | AOI | EOD | PE | U |
|---|---|---|---|---|
| aoi1 | **0.712** | 0.539 | 0.208 | 0.441 |
| aoi2 | **0.836** | 0.618 | 0.417 | 0.672 |
| aoi3 | **0.708** | 0.641 | 0.573 | 0.612 |
| aoi4 | **0.804** | 0.467 | 0.412 | 0.538 |
| aoi5 | **0.655** | 0.366 | 0.626 | 0.411 |
| eod1 | 0.635 | **0.885** | 0.524 | 0.617 |
| eod2 | 0.574 | **0.756** | 0.330 | 0.499 |
| eod3 | 0.479 | **0.741** | 0.436 | 0.489 |
| eod4 | 0.525 | **0.689** | 0.585 | 0.539 |
| eod5 | 0.509 | **0.662** | 0.305 | 0.468 |
| eod6 | 0.380 | **0.600** | 0.207 | 0.351 |
| pe1 | 0.421 | 0.394 | **0.741** | 0.538 |
| pe2 | 0.366 | 0.371 | **0.588** | 0.595 |
| pe3 | 0.516 | 0.655 | **0.641** | 0.569 |
| pe4 | 0.521 | 0.432 | **0.841** | 0.535 |
| pe5 | 0.345 | 0.249 | **0.743** | 0.588 |
| pe6 | 0.461 | 0.394 | **0.815** | 0.525 |
| u1 | 0.584 | 0.541 | 0.583 | **0.849** |
| u2 | 0.519 | 0.407 | 0.581 | **0.764** |
| u3 | 0.570 | 0.461 | 0.529 | **0.806** |
| u4 | 0.696 | 0.667 | 0.624 | **0.884** |
| u5 | 0.436 | 0.398 | 0.541 | **0.639** |
| u6 | 0.557 | 0.648 | 0.524 | **0.669** |

Perceived usefulness (AOI); User adoption (U); Perceived ease of use (EOD); Perceived enjoyment (PE)

Table 2
Reliability Analysis

| Constructs | Cronbach Alpha | CR | AVE |
|---|---|---|---|
| Perceived usefulness | 0.799 | 0.861 | 0.556 |
| Ease of use | 0.817 | 0.869 | 0.529 |
| Perceived enjoyment | 0.862 | 0.898 | 0.598 |
| User adoption | 0.824 | 0.873 | 0.537 |

Perceived usefulness (AOI); User adoption (U); Perceived ease of use (EOD); Perceived enjoyment (PE)

#### *c. Discriminant Validity*

Table 3 shows the outcome of the discriminant validity. Fornell and Larcker [24] suggested that correlations between items in any two constructs should be lower than the square root of the average variance shared within a construct. In this study, there are no high cross-loadings of items in one construct with items in other constructs. The square root of the average variance extracted (AVE) of each variable is larger than its correlations with other latent variables (constructs). Since, the square root of all AVE scores (diagonal elements in Table 3) were much higher than all other cross correlations (off-diagonal elements in Table 3), the measures have good discriminant validity.

Table 3
Discriminant Validity

| Constructs | AOI | EOD | U | PE |
|---|---|---|---|---|
| AOI | **0.745913** | | | |
| EOD | 0.720039 | **0.727401** | | |
| U | 0.735849 | 0.689801 | **0.773664** | |
| PE | 0.597617 | 0.565892 | 0.574692 | **0.733445** |

Perceived usefulness (AOI); User adoption (U); Perceived ease to used (EOD); Perceived enjoyment (PE)

*d. Predictive Quality of the Model*

The R square provides the predictive quality of a model. It shows the proportion of the explanatory variables that account for the variability in the response variable. In this study, the three explanatory factors: perceived usefulness, perceived ease of use and perceived enjoyment, jointly accounted for 61% of the variability in user adoption. The model has a relatively good predictive quality.

Table 4
Predictive Quality of the Model

| Constructs | R Square | AVE | GOF |
|---|---|---|---|
| AOI | | 0.556386 | |
| EOD | | 0.529112 | |
| PE | | 0.537941 | |
| U | 0.607975 | 0.6816 | |
| Average | 0.608 | 0.682 | 64% |

*C. Measurement Model*

The structural model reveals the path linking perceived usefulness, perceived ease of use, and perceived enjoyment to user adoption of interactive mobile map (see Figure 1).

Table 5
Test of Hypothesis

| | Hypotheses | Standard Deviation | Standard Error | t-Statistics | P-Value |
|---|---|---|---|---|---|
| H1 | AOI ->U | 0.052 | 0.052 | 8.345 | 0.000 |
| H2 | EOD ->U | 0.048 | 0.048 | 6.048 | 0.000 |
| H3 | PE->U | 0.041 | 0.041 | 3.605 | 0.000 |

Perceived usefulness (AOI); User adoption (U); Perceived ease of use (EOD); Perceived enjoyment (PE):p<0.001

The above table shows the result of the relationship between each explanatory factor and the response variable. Perceived usefulness, perceived ease to used, and perceived enjoyment are each significantly associated with user adoption of interactive mobile maps. The three hypothesis tested in this study were supported and confirmed. Thus, perceived usefulness has positive effect on user adoption of interactive mobile maps (this confirms hypothesis one, H1). Perceived ease of use has positive effect on user adoption of interactive mobile maps (confirming hypothesis two, H2). In addition, perceived enjoyment also has a positive effect on user adoption of interactive mobile maps (confirming hypothesis three, H3). Therefore, the three independent variables considered in this study: perceived usefulness, perceived ease of use, and perceived enjoyment, are significant antecedents to the user adoption of interactive mobile maps, thus further confirming the TAM's model. Users consider these factors very importance in their adoption or in their intention to use interactive mobile maps.

## V. Conclusions

This study examines the user perception of usefulness, ease of use and enjoyment as antecedents to user adoption of interactive mobile map. TAM model was used to evaluate users' adoption of interactive mobile maps using three beliefs or constructs as antecedents. Quantitative research (survey) methodology was used and the analysis and findings revealed that all the three explanatory factors used in this study, explain the user adoption of interactive mobile maps. Perceived usefulness, perceived ease of use, and perceived enjoyment each have significant positive effect on user adoption of interactive mobile maps. In this study, the three beliefs: perceived usefulness, perceived ease of use and perceived enjoyment, clearly showed that they are determinants to users' adoption of the interactive mobile maps. Though the three constructs have been used in previous research as antecedents to user adoption of certain information technologies, however, they have not been used or examined in the context of interactive mobile map. This study tested three hypotheses, 1. Perceived usefulness has a positive effect on user adoption of interactive mobile maps, 2. Perceived ease of use has a positive effect on user adoption of interactive mobile maps, and 3. Perceived enjoyment has a positive effect on user adoption of interactive mobile maps. The three hypotheses were all supported and confirmed. In conclusion, the study further confirms and validates the TAM model.

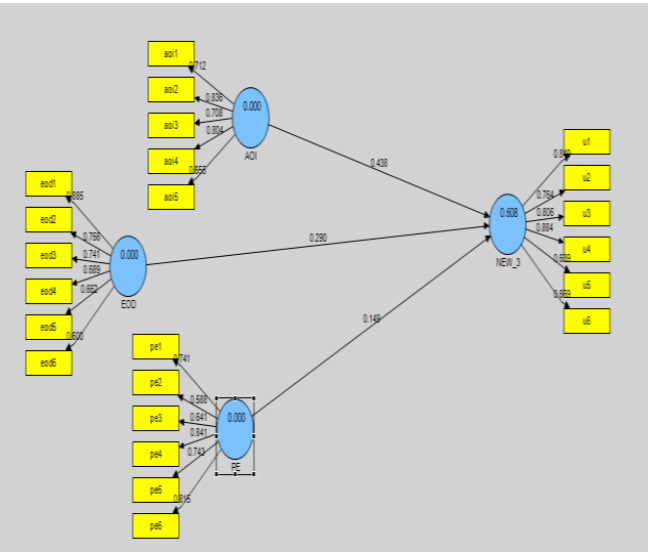


Figure 1: Structural model for the study

## References


[1] G. Leitner, S. Plattner, M. Hitz, "Usability Evaluation of mobile Applications in leisure oriented Contexts". 13th Int'l Conf. on Info. & Comm. Technologies in Tourism, Lausanne, Switzerland, 18 - 20 January 2006.

[2] J. Lee, J. Forlizzi, S.E. Hudson, "Iterative Design of MOVE: A Situational Appropriate Vehicle Navigation System", Human-Computer Interaction Institute and School of Design, Carnegie Mellon University, Pittsburgh, PA, USA. 2005.

[3] J. Kjeldskov et al., "Evaluating the Usability of a Mobile Guide: The influence of Location, Participants and Resources". Behavior and Information Technology (BIT), vol.24, no.1, 2005, pp.51- 65.

[4] J. Kjeldskov, C. Graham, "A Review of Mobile HCI Research Methods". 5th Int'l Conf. on Human-Computer Interaction with Mobile Devices and Services, Udine, Italy, 8-11 September 2003, pp.317-335.

[5] P.W. Jordan, An introduction to Usability. London: Taylor & Francis Ltd, 1998.

[6] A. Hinze, G. Buchanan, "Context awareness in Mobile Tourist Information Systems: Challenges for User Interaction". 7th Int'l Symp. on Human Computer Interaction with Mobile Devices and Services 2005.

[7] F. Heidmann, F. Hermann, M. Peissner, "Interactive maps on Mobile, Location-Based Systems: design solutions and usability testing". In Mobile Cartography, International Cartographic Conference (ICC 2003), Durban, South Africa, 10 - 16 August 2003, International Cartographic Association, pp.1299-1306

[8] T. Reichenbacher, Mobile Cartography - Adaptive Visualisation of Geographic Information on Mobile Devices. PhD Dissertation, Department of Cartography, Technical University of Munich, Germany, 2004.

[9] R,S. Nagi, Cartographic visualization for mobile applications. MSc Thesis, Int'l Institute for Geo-Information Science and Earth Observation (ITC), Enschede, the Netherlands, December, 2004.

[10] C. Düpmeier, et al., "Using SVG-based Maps for Mobile Guide Systems: A Case Study for the Design, Adaptation, and Usage of SVG-based Maps for Mobile Nature Guide Applications". 4th Annual Conf. in scalable Graphics, 15-18 August 2005) Enschede, the Netherlands.

[11] J. Markoulidakis, et al., "Mobility Modeling in Third-Generation Mobile Telecommunications Systems". IEEE Personal Comm., vol.4, no.4, 1997, pp.41.56.

[12] I. Ajzen, "From intentions to actions: a theory of planned behavior", in J. Kuhlman and J. Beckmann eds. Action Control J. Springer, 1985, pp.11

[13] S. Ha, L. Stoel, "Customer e-shopping acceptance: antecedences in a technology acceptance model". J. Bus. Res., vol.62, 2009, pp.565-571.

[14] D. Nguyen, Understanding perceived enjoyment and continuance intention in mobile games. Master' Thesis, Aalto University, Finland, 2015.

[15] M. Chutter, "Overview of the technology acceptance model: origins, developments, and future directions". Working paper on Information Systems, vol.9, no.37, 2009.

[16] F.D. Davis, R.P. Bagozzi, P.R. Warshaw, "Extrinsic and intrinsic motivation to us computers in the workplace", J. Applied Social Psychology, vol.22, no.14, 1992, pp.1111- 1132.

[17] D. Cyr, M. Head, A. Ivanov, "Design aesthetics leading to m-loyalty in mobile commerce". Info & Manag., 2006, pp.950-963.

[18] F.D. Davis, "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology", *MIS Quarterly*, vol.13, 1989, pp.319-340.

[19] M. Zhu, F. Nah, F. Zhao, "Factors influencing users' adoption of mobile computing" , in J. Mariga (ed.) Managing e-commerce and mobile computing technologies , Idea Group Pub., Hershey, PA, 2003, pp.260-271.

[20] M. Igbaria, T. Guimaraes, G.B. Davis, "Testing The Determinants Of Microcomputer Usage Via Structural Equation Model", *J. Manag. Info. Systems*, vol.11, no.4, 1995, pp.87-114.

[21] J.W. Moon, Y.G. Kim, "Extending the TAM for a World-Wide-Web context", Info. & Manag., vol.38, 2001, pp.217-230.

[22] J,F. Hair, W.C. Black, B.J. Babin, R.E. Anderson, Multivariate data analysis: a global perspective, Pearson Education, 2010.

[23] L.J. Cronbach, "Test validation", in R.L. Thorndike (ed.), Educational measurement, 2nd ed. Washington, DC: American Council on Education, 1971, pp.443-507.

[24] C. Fornell, D.F. Larcker, "Evaluating structural equation models with unobservable variables and measurement error". *J. marketing research*, 1981, pp.39-50.

[25] A. Hussain, E.O.C. Mkpojiogu, Z. Hussain, "Usability evaluation of a web-based health awareness portal on Smartphone devices using ISO 9241-11 model". *Jurnal Teknologi*, vol.77 no.4, 2015, pp.1-5.

[26] A. Hussain, E.O.C. Mkpojiogu, "An application of ISO/IEC 25010 standard in the quality-in-use assessment of an online health awareness system". *Jurnal Teknologi*, vol.77, no.5, 2015, pp.9-13.

[27] A. Hussain, E.O.C. Mkpojiogu, E.O.C. "The effect of responsive web design on the user experience with laptop and Smartphone devices". *Jurnal Teknologi*, vol.77, no.4, 2015, pp.41-47

[28] I. Ajzen, M. Fishbein, Understanding attitudes and predicting social behavior, Englewoods Cliffs, NJ.: Prentice-Hall, 1980.

[29] V. Venkatesh, M.G. Morris, G.B. Davis, F.D. Davis, "User acceptance of information technology: toward a unified view". MIS Quarterly, vol.27, 2003, pp.425-478

[30] A. Hussain, E.O.C. Mkpojiogu, F. Hassan. "Systematic review of mobile learning applications for children". Proceedings of the 2nd *International Conference on Information and Communication Technology for Transformation (IC-ICT4T'16)*, 5-7 April 2016, Kota Kinabalu, Sabah, Malaysia.

[31] A. Hussain, E.O.C. Mkpojiogu. "Usability evaluation techniques in mobile commerce applications: a systematic review". Proceedings of the *1st International Soft Science Conference (ISSC'16)*, 11-13 April 2016, Langkawi Island, Malaysia.

[32] A. Hussain, E.O.C. Mkpojiogu, "A systematic review of usability test metrics for mobile video streaming apps". Proceedings of the *1st International Soft Science Conference (ISSC'16)*, 11-13 April 2016, Langkawi Island, Malaysia.

[33] E.O.C. Mkpojiogu, N.L. Hashim, R. Adamu. "Observed demographic differentials in user perceived satisfaction on the usability of mobile banking applications". 8th Knowledge Management International Conference (KMICe'16), Chiang Mai, Thailand, 29-30 August 2016.

[34] Hussain, A., & Mkpojiogu, E.O.C. A systematic review on usability evaluation methods in m-commerce apps. Journal of Technology, Electronics & Computer Engineering (JTEC), 2016.

[35] Hussain, A., & Mkpojiogu, E.O.C. Mobile video streaming applications: A systematic review of test metrics in usability evaluation. Journal of Technology, Electronics & Computer Engineering (JTEC), 2016.