ISSN No:-2456-2165

User-Centered Design: A Strategy to Create Easy-to-use Banking ATM System Interfaces in Nigeria

Dr. Felix. C. Aguboshim
Principal Lecturer, Federal Polytechnic Oko. Nigeria.
Doctoral graduate, Walden University, Baltimore US.

Dr. Gail. S. Miles
Professor, College of Information Systems and Technology
Walden University, Baltimore US.

Dr. Felix. C. Aguboshim
Principal Lecturer, Federal Polytechnic Oko. Nigeria.

Abstract:-The use of banking automated teller machine (ATM) technological innovations have significant importance and benefits in Nigeria, but illiterate and semiliterate Nigerians, representing about 40.33%, do not perceive them as useful or easy-to-use. The purpose of this case study was to identify strategies used by software developers of banking ATM systems in Nigeria to create easy-to-use banking ATM system interfaces in Nigeria. The technology acceptance model was adopted as the conceptual framework. One organization in Enugu, Nigeria was used for this study's population. Data were collected through semi-structured, in-depth face-to-face interviews with nine banking ATM system interface developers and the analysis of 11 documents. Findings from the participants were validated through member checking and organizational documents. Through methodological triangulation one major theme emerged: importance of user-centered design strategies, that encompass five important components: (a) user-centered design processes, (b) importance and understanding of the cultural backgrounds and literacy levels of users, (c) design based on knowledge and understanding of users' needs, (d) importance of understanding the target users, and (f) simple, user friendly, and easy to use design. The findings in this study provide direction for the future development of strategies to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels and other information technology systems that are user interface technology dependent.

***Keywords*:-** *ATM, user centered design, interface, easy-to-use, ease of use, literacy levels, target users.*

I. INTRODUCTION

ATM technological innovations have significant importance in Nigeria, especially in the banking sectors (Titilope, 2015). A survey report by Enhancing Financial Innovation and Access reported that only 7.9% of Nigerians use ATM's, and 53% of adult Nigerians who are bank customers use their ATM cards (EFInA, 2014). Written language level used by software developers in their design is one of the important factors that affect easy-to-use ATM system interfaces (Jimoh & Babatunde, 2014). United Nations Educational, Scientific, and Cultural Organization Statistic Report found that 40.33% of Nigerians aged 15 years or older are illiterate or semiliterate(UNESCO, 2015). In Nigeria, the existing banking ATMs do not adequately cater for these 40.33% illiterate or semiliterate adults. The existing ATM system interfaces in Nigeria have failed to provide easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels which support the need for this research to identify design strategies to improve ATM interfaces in Nigeria. We postulate that the general IT problem is the lack of easy-to-use ATM system interfaces for people with varying abilities and literacy levels, while the specific IT problem is that some software developers of banking ATM systems in Nigeria lack strategies to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels.

An interface that fails to incorporate the user, and "compromise" the users' varying abilities and capabilities that determines whether or not the product will be easy-to-use, has failed (Hyysalo & Johnson, 2014). One significant setback of banking ATM system adoption in Nigeria is that ATMs lacked a customized user-friendly interface, not flexible, expressive or easy to use. As a result, the ATMs appear complex and difficult to use. To the ATM user, the interface is the product, not necessarily the ATM machine (Zhang, Wang, Deng, & Yin, 2013) and the most critical component of the ATM system that determines ATM acceptability (Darejeh & Singh, 2014a). Poorly designed ATM user interface is not easy-to-use or usable, no matter how well the machine performs (Alshameri & Karim-Bangura, 2014). According to the World ATM Benchmarking Study 2014 and Industry Report, the ATM interface affects usability (as cited in Burelli, Gorelikov, & Labianca, 2014). Usability defines how efficient, effective and easy it is for the user to use a product to perform prescribed tasks and achieve the desired goals.

Software developers of banking ATM systems in Nigeria have been inventive through in-depth study about users' literacy levels and cultural differences as they affect users' interaction with the ATM system interfaces. With the availability of information on cultural and literacy differences among users, one might think that designing easy to use system interfaces would be easy. If designing system interfaces appeared so easy with the available information on cultural and literacy differences among users, why are some software developers of banking ATM systems in Nigeria lack strategies

to create easy-to-use ATM system interfaces for those individuals with different abilities and literacy levels? Software developers of banking ATM systems in Nigeria can provide answers to the following questions: how does culture of user impact strategies to create easy-to-use ATM system interfaces? How does literacy level of user impact strategies to create easy-to-use ATM system interfaces? How are cultural and literacy differences effectively harnessed to create easy-to-use banking ATM system interfaces? What aspects of developers' design strategies contributed to an easy-to-use interface, and ensured that banking ATM system interfaces created will be acceptable by a variety of people with varying abilities and literacy levels?

The answers to these questions provided an in-depth study to identify, understand, support, and explain strategies software developers of banking ATM systems in Nigeria use to create easy-to-use banking ATM system interfaces. These questions that formed part of our interview questions addressed our research question: "What are strategies used by software developers of banking ATM systems in Nigeria to create easy-to-use ATM system interfaces"? The target population for this study was qualified and experienced banking ATM system interface developers who had strategies to create easy-to-use ATM system interfaces for people with people with varying abilities and literacy levels. The geographical location was the Enugu State of Nigeria. One ATM system interface developer organization in Enugu served as the case study. There were two major sources of data, which were nine semi structured interviews and 11 documents that focused on strategies to create an easy-to-use banking ATM system interface.

II. LITERATURE REVIEW

In this section, we present related literature in user interface systems that are primarily created for existing banking ATM user interface systems whose design processes centered around the users' cultural backgrounds and literacy levels and based on knowledge and understanding of users' needs. We also looked at some peculiar usability challenges of ATMs in Nigeria and the existing tools and strategies for developing easy-to-use ATM system interfaces. An overview of useful concepts and conceptual framework that framed the descriptions of our studies and the framework we used for our analysis is presented. Existing relationships among usability variables and ATM system service quality is reviewed. Finally, we describe the concept of user centered design strategies and how we can leverage this idea to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. These laid the foundation and motivation for this study and helped understand the synergetic impact of the components needed for ATM system interface developers to adopt user-centered design strategies for the success of creating easy-to-use ATM system interfaces. These reviews also uncovered new approaches to sustainable interface design.

A. Conceptual Framework

We adopted the information system theory called the technology acceptance model (TAM) as the foundation for this study. The TAM was developed by Davis in 1989, based upon the psychology-based theory of reasoned action (TRA) and theory of planned behavior (TPB). TAM was adopted because it demonstrates how users come to accept and use technology by presuming two variables called perceived ease of use (PEOU) and perceived usefulness (PU) as primary determinants in a complex but mediating relationship between system characteristics (external variables) and potential system usage. PU reflects the expected benefits from using the new technology, while PEOU reflects the perceived behavioral attitude in the theory of planned behavior (Davis, 1989). Researchers have made various claims on how PU and PEOU are often determined by a perceived attitude towards technology (Gangwar, Date, & Raoot, 2014; Gao & Bai, 2014); cognitive ability (Chen, Liu, Li, & Yen, 2013); social, cultural, and political influences (Kaushik & Rahman, 2015; Patsiotis, Hughes, & Webber, 2013); self-efficacy (Teoh, Siong, Lin, & Jiat, 2013); facilitating conditions (Chen & Chan, 2013; Tsai, 2015); usability measurement attributes (Hsiao & Tang, 2015; Lin, 2013a); and effectiveness, efficiency, learnability, and memorability (Chen & Chan, 2013; Lin, 2013b).

A conceptual framework that integrates TAM, TPB and technology-organization-environment (TOE), and the external variables that often influence PU and PEOU enumerated above, were insightful to the understanding of user centered design as an important strategy to create easy-to-use banking ATM system interfaces for a variety of people with varying abilities and literacy levels. This is because, according to Joo, Lee, and Ham (2014), user centered design interface and perceived ease-of-use significantly influence PU, and perceived ease-of-use has a significant effect on satisfaction among users. Designing an easy-to-use system interface is equivalent to designing a new technology. It is therefore necessary to incorporate the interface within the User Centered Design factors that will make the new technology acceptable to users. An understanding of TAM and how PU and PEOU are often determined by how the perceived attitude towards technology acceptance will impact the understanding of the strategies developers in Nigeria use to create easy-to-use Banking ATM user interface. This property of TAM makes TAM to be the preferred user-acceptance model for this study which focuses on strategies developers use to create easy-to-use banking ATM system interfaces for a variety of people with varying abilities and literacy levels.

B. Existing Usability Challenges of Banking ATM User Interfaces in Nigeria

There are contributions in recent literature that pointed to existing and peculiar usability challenges of ATMs in Nigeria. While there are varied opinions and contributions to usability challenges of banking ATM user interfaces in Nigeria, one central core and significant usability challenge identified among the authors were that banking ATM system adoption in Nigeria showed usability defects and user experience issues that can be frustrating (Jegede, 2014), manifested by lack of customized user-friendly interfaces that are tied to users' literacy levels, and cultural differences. Contributing to this, Zhang, et al. (2013) argued that ATM interface developers in Nigeria have failed to realize that, to the ATM user, the interface is the product and the most critical component that determines ATM acceptability. As a result, the utilization and

profitability of ATM systems in Nigeria are affected by how the ATM system interface influences users in terms of users' literacy levels, and cultural differences. This is supported by Darejeh and Singh (2014a), and Jimoh and Babatunde, 2014) who found that banking ATM user interfaces in Nigeria lack simple and easily understandable design and contents that rendered them not easy-to-use or not well understood by all users with varying abilities and literacy levels.

Another study by Alfimtsev, Basarab, Devyatkov, and Levanov (2015), analyzed the values of human brainwaves when dealing with human computer interface (HCI), and claimed that the brainwaves indicate "calm" when working with a friendly interface and "exited" or "nervous" or "agitated" when dealing with inconvenient HCI. According to the study, the average values of brainwaves in calm and excited states depend on the interface usability (Alfimtsev, et al., 2015). This recent claim by Alfimtsev, et al. (2015), supported Zhang, et al. (2013)'s claim that when users are agitated because the HCI is not easy-to-use, more time is wasted on the ATM machine, resulting in long queue or much crowd at the ATM center. In Nigeria, some ATM user interfaces have remained notoriously user-unfriendly because the developers of these ATM user interfaces have assumed that ATMs are the province of the specialized or literate users (Darejeh & Singh, 2014b). This assumption failed because the ATMs are not easy-to-use by all people of varying abilities and literacy levels who are denied the use of ATMs (Omari & Zachary, 2013). In this study, we aimed to identify strategies software developers of banking ATM systems use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels.

An ATM interface that is easy-to-use in one country may produce a frustrating experience and usability problem in another country (Ilyas, Ahmed, & Alshamari, 2013). This is because interface usability is affected by the literacy level and cultural background of the user, among others (Ilyas et al., 2013).In Nigeria, peculiar usability challenges that are associated with these ATM system interfaces exist that need to be understood and resolved because user interface for ATM systems influence users with respect to their literacy levels and cultural differences and may encourage either secure or unsecure behavior (Conti, Collotta, Pau, & Vitabile, 2014).The ATM user interface should be designed or redesigned with the user in mind, meaning that the principles of User centered design strategies should be incorporated into the ATM interface design process to produce secure authentication interfaces that are effortless, and easier for users (Betab, & Sandhu, 2014; Bose, 2013; Kassem, Mekky, & EL-Awady, 2014; Kumar, et al., 2014).

Most Banking ATMs are not designed within Nigeria but purchased by the banks from companies that specialize in ATM development. Therefore, ATM interfaces ought to be customized to improve user experience in the aspect of user centered interface design (Hoehle, Zhang, & Venkatesh, 2015; Jung-min & Nammee, 2013; Oh & Moon, 2013) that incorporates facilities that guarantee customers' perceived trust (Kazi & Mannan, 2013). A good user interface should be customized, intuitive, interactive, user centered, and easy-to-use (Chin-Feng, Po-Sheng, Yueh-Min, Chen, & Tien-Chi, 2014). Re-designing user interfaces of banking ATMs to make them easy-to-use to improve customer satisfaction and user experience in not new in the world and not peculiar to Nigeria. According to Zhang, et al. (2013, p.23), Wells Fargo, a well-known bank in the US, redesigned their banking ATM user interface to improve customer satisfaction and user centered experience. This exercise improved the aesthetic appeal of the interface by implementing touch screens as input/output devices that set up profile-based functions in the system (Zhang, et al., 2013). In Nigeria, system interface experts have always studied most of these peculiar Nigerian situations that may initiate a redesign process that could serve as feedback to the ATM builders, if it goes beyond system and terminal interfaces redesign. Building on this concept, we suggest that banks in Nigeria should not take the user interface from ATM builders designed for other countries verbatim, because interface usability answers to the literacy levels, culture and behavior that are peculiar to a locality or country. Furthermore, system interface developers are very much needed to continually customize these ATMs to suit Nigeria's literacy and cultural environmental peculiarities.

C. Existing Interface Design Models and Frameworks

In this study we researched existing interface design models and framework whose contexts agree with the two primary determinants of TAM: PEOU and PU that supports user centered design strategies. According to Bhattacharya and Laha (2013), interface design that supports TAM should consider the users and tasks, know who they are, and what goals they try to achieve. Such interface design should be user centered to deploy a task-based approach for design and the evaluation process (Kwan, Paquette, Magee, & Betke, 2014; Pribeanu, 2014). An ideal user-centered interface (UCI) should allow a consistent, intuitive and simple control of a multi-function system with minimal user training, aside being perceived by the user as easy-to-use and useful (Gonzalez-Vargas, Dosen, Amsuess, Yu, & Farina, 2015). Designing a UCI with these characteristics is a challenging task, especially in meeting the needs of variety of people with varying abilities and literacy levels including users with impaired motor and sensory capacities (Gonzalez-Vargas, et al., 2015; Ilyas et al., 2013).

Some authors in recent literature assert that usability and user interface quality are the major factors recognized in literature for software to succeed (Bakaev, & Avdeenko, 2013; Bhattacharya, & Laha, 2013; Caine et al., 2015; Chu, & Tanaka, 2015; Pribeanu, 2014). In addition, about 50% of all program code produced when information systems applications are built is devoted to user centered interface quality design (Bakaev, & Avdeenko, 2013).User centered interface design models and frameworks identified three major areas of concerns that evaluate usability: effectiveness, efficiency and satisfaction, while considering multiple target user groups (e.g. users with differing abilities and literacy levels), as applicable in this study. Overall, usability was the success criterion for all the proposed models. Against this background we reviewed existing interface design models that support TAM in order to support ATM system interface developers.

D. *Existing Tools and Strategies for Developing Easy-To-Use System Interfaces*

Additionally, we focused on understanding what makes banking ATM system interface design to be imperative for high ATM usability levels. It has been claimed by researchers that customized, tailor-made and easy-to-use ATM system interfaces that will cater for a variety of people with varying abilities and literacy levels should be of high usability levels (Giakoumis, Kaklanis, Votis, & Tzovaras, 2014; Hyysalo & Johnson, 2014). Hoffmann and Söllner (2014), while incorporating behavioral trust theory into system development for ubiquitous applications was the key factor for technology adoption by users, meaning that users prefer to use applications they trust. Good user interface that should incorporate good and easy-to-use authentication should embed trust as a major aspect of information security and authentication (Hoffmann & Söllner, 2014). Kapoor, Dwivedi, Piercy, Lal, and Weerakkody (2014) opined that usability or easy-to-use interfaces will influence the user attitude and system quality which significantly will influence the use of the system services. From Cheng's (2014) study, information quality, system quality, support service quality, and instructor quality contributed significantly to PU. This finding greatly supports this study because information quality, system quality, support service quality, and instructor quality can be embedded in a banking ATM system interface to make the system easy-to-use and useful.

Fillion and Ekionea (2014) in their study considered many socioeconomic variables such as age, utility for work-related use, declining cost, applications for fun, mobility, perceived ease of use and utility for security. They found perceived ease of use and utility for security as the two most significant variables that influence adoption. Omari and Zachary (2013) focused on visually impaired persons and suggested incorporation of biometric features as essential tools to ensure secured banking ATM systems. This result added to the studies on user interface challenges in banking ATM systems. Zhang, et al. (2013) contended that banking ATM system developers should consult extensively with banking ATM users to help design and create banking ATM systems which are easy to use and efficient. Banking ATM system interface designers must understand how users can tell whether an interface background display is interactive or not and how they can tell what the interface is intended to achieve with minimal mental efforts (Shaer et al., 2014).

Developers of user interfaces should also use tools to experience accessibility challenges or limitations that can be implemented from various disabilities platform to provide good and realistic simulations over them (Giakoumis, et al., 2014). Banking ATM system interface developers must be human-centered and work in an environment that provides best understanding of the user to be able to act as user advocates within the development organization (Hyysalo & Johnson, 2014). A good system developer should serve as a user advocate within the development domain and use suitable tools and technique to gain good understanding of the abilities and capabilities of the broad range of users, while creating an easy-to-use system interface for users (Keates, 2015). Banking ATM user interfaces that empower usability in terms of speech technology and biometric authentication like finger print verification may encourage non-users to use ATMs, improve usability for all, and present strategies for developing easy-to-use and efficient banking ATM system interfaces.

III. METHODOLOGY

The research question that guided our study was as follows: What are strategies used by software developers of banking ATM systems in Nigeria to create easy-to-use ATM system interfaces? We adopted a qualitative case study design methodology that provided rich, in-depth study of the participants' experiences, and the adoption of context-based multiple in-depth data collection from multiple sources, and primarily inductive analysis and reporting. Our focus for this study was exploratory in nature. Therefore, we adopted a qualitative research that offered the best opportunity to explore multiple, in-depth data collection and analysis to generate the expected reports, codes and themes. Our data for this research study came from semistructured interviews we conducted with one ATM system interface developer organization in Enugu, Nigeria, and from documentation from participant case organizations and other nonparticipant case organizations. Data also came from the field notes and reflective journals. Our intention was to gain in-depth knowledge of strategies developers use to create easy-to-use banking ATM system interfaces. In-depth gathering of knowledge to explore and discover meaning are often associated with data generally gathered in words, texts, and images (Odeyemi, 2017). Qualitative case study approach is involved in the gathering of data in words, texts, images, including non-verbal cues, to explore in-depth thoughts of participants (Odeyemi, 2017). The interview questions for this study were focused on how and what strategies were used by participants because our interest was centered on the participant's thoughts, aimed to create understanding and to reflect the diversity in the population of study. Qualitative case study research method was deemed suitable because our research is largely exploratory in nature and intended to gain in-depth understanding and richness of insights from participants' thoughts, to the generalizability of the results from data.

We chose a pre-defined population within a specific geographic area. The use of multiple data sources is emphasized to gain multiple perspectives and validation of data (Carter, Bryant-Lukosius, Blythe, & Neville, 2014). The phenomenon of interest (the case) is the strategies used by ATM system interface developers to create easy-to-use ATM system interfaces for people with varying abilities and literacy levels. The analysis methods adopted in this study further developed and explored the case because the analysis processed interview data, generated reports, codes that will continue to impact new understanding of the study topic, as revealed by the themes and sub-themes. We adopted a holistic single case approach that explored the case by the different decisions and opinions explored from different case participants within one specific case. We deemed single case study design appropriate for our study.

ISSN No:-2456-2165

One organization that has successfully demonstrated experience and strategies in creating easy-to-use banking ATM system interfaces for people with varying abilities and literacy levels was selected as our target population. We selected participants from a banking ATM interface developer organization who have the required English proficiency, are 18 years or older, have strategies to create easy-to-use ATM system interfaces for people with varying literacy levels, within the last three years, and live in Enugu, Nigeria. A set of techniques that clearly defines the boundaries for participants by stating a set of inclusion or exclusion criteria for the samples is important (Dixon, 2015; Robinson, 2014). Such eligibility criteria, which are formally documented as part of the protocol for the study are perceived to be necessary for selecting participants in a qualitative case study because they majorly result to less varied populations (Morar, et al., 2015; Noyes, et al., 2016). Our contact with the case study organization provided an estimated population size of twelve developers who meet the participation eligibility criteria. Because of the small population size, resulting from the eligibility criteria that defined the population of the study, we interviewed all the twelve participants who were eligible for individual in-depth interviews. According to Etikan, Musa, and Alkassim (2016), census sampling, a type of purposeful sampling is generally chosen where the number of cases being investigated is relatively small. We used purposeful census sampling and identified all twelve members of the eligible participants that meet the eligibility criteria. We maintained a high standard of ethical considerations throughout the stages of the interview process.

IV. DATA COLLECTION AND ANALYSIS

From the selected case organization, 12 developers met the participation eligibility criteria. One participant declined, and another travelled out of town (Enugu), leaving a total of 10 participants who were interviewed. As a strategy towards conducting credible research and to ensure data saturation, we interviewed all participants who consented and were available until there was no new information being provided and no new major emerging codes and categories. Data saturation from the interview data was reached with the ninth participant. Data collection process included semi structured, in-depth face-to-face interviews with these 9 banking ATM system interface developers and the analysis of 11 documents: 5 from participant case organizations and 6 from nonparticipant case organizations. Five documents provided for use by the participant case organization centered on regulations and ATM technology and specification, user interface design guidelines for creating easy to use interfaces, user requirements analysis procedures, proactive and reactive (feedback) guidelines, and system development and simulation procedures. We were also provided with six documents from nonparticipant case organizations, two of which came from Central Bank of Nigeria: Standards and Guidelines on ATM Operations in Nigeria and Guidelines on Operations of Electronic Payment Channels in Nigeria. One other document specifically contained 80 ATM system interface screen shots. Other documents included our field notes and reflective journals that contained some major issues raised during the interviews. The distribution of these 11 documents is shown in Table 1.

Participant case organization	Sources of Documents Reviewed				
	Nonparticipant case organization				
	CBN	80 ATM system interface screen shots	Systems Development Life-Cycle Phases	Field notes	Reflective journals
n=5	n=2	n=1	n=1	n=1	n=1
Regulations and ATM technology and specification	Standards and guidelines on ATM operations in Nigeria	80 ATM system interface screen shots	Systems Development Life-Cycle Phases	Field notes	Reflective journals
User interface design guidelines for creating easy to use interfaces	Guidelines on Operations of Electronic Payment Channels in Nigeria				
User requirements analysis (proactive) procedures					
Reactive (feedback) guidelines					
System development and simulation procedures					

Table1 Documents Reviewed by Sources

Note. n = number of documents

The hallmark of case study research has been emphasized by researchers as the use of multiple data sources, a strategy to gain multiple perspectives and validation of data (Carter, et al., 2014; Kaufmann, Stämpfli, Hersberger, & Lampert, 2015; Ledo-Andión, López-Gómez, & Castelló-Mayo, 2017), which also enhances data credibility, and triangulation (Hanney, Greenhalgh, Blatch-Jones, Glover, & Raftery, 2017; Mccardle, & Hadwin, 2015; Patton, 2015).The consensus of many qualitative case study researchers on data saturation, is that data saturation is achieved by continuous collection of enough data to the point where additional input from further sources of data do not continue to generate new information (Marshall, Cardon, Poddar, & Fontenot, 2013; Veletsianos, & Shepherdson, 2016), or continue to impact the research question (Suárez-Guerrero, Lloret-Catalá, & Mengual-Andrés, 2016), or generate new themes (Coorey, et al., 2017). We achieved data saturation when the transcripts were no longer revealing new information or new themes in the subsequent interview data. We further ensured data saturation by gathering multiple sources of data from participant interviews, case organizations' regulations, policies, and design guidelines documents that are focused on strategies to create easy-to-use banking ATM system interface from participant case organization and from other non-participant case organizations. Member checking was recommended by researchers as the most crucial technique for establishing validity and credibility of instruments used in a qualitative case study (Morse, Lowery, & Steury, 2014). We used member checking to increase the reliability and validity of the findings from the participants.by providing each participant a summary of the interview to verify we understood the intent of the responses. Through member checking, we allowed participants an opportunity to verify the accuracy of the interview. For a case study that employs both interviews data and data from other sources, methodological triangulation has been recommended to further secure data saturation (Ray, 2017; Visser, Bleijenbergh, Benschop, Van Riel, & Bloem, 2016). We employed methodological triangulation to facilitate validation of multiple sources of data collected through interviews, observations, and documents. Analysis of data was facilitated using ATLAS.ti7 (version 7).

V. FINDINGS

One emergent theme from the data analysis was the importance of user-centered design strategies. User-centered design strategies are important for the success of creating easy-to-use ATM system interfaces. Findings showed that this theme encompassed the following important elements: user-centered design processes, importance of understanding cultural backgrounds and literacy levels of users, design is based on users' needs, importance of understanding the target users, and simple, user friendly, and easy to use designs. These components are needed for ATM system interface developers to adopt user-centered design strategies for the success of creating easy-to-use ATM system interfaces. Table 2 shows these five important components of the user-centered design strategy as evident from this study and the frequency (number) of participants who noted they engaged in these important components of user-centered design strategy. Table 2 also shows the frequency (number) of supporting documents that contained important components of User-Centered design strategy (the theme).

Source of data collection	Important components of user-centered design strategy				
	Centers design process around the user (f)	Understands the cultural backgrounds and literacy levels of users (f)	Design based on knowledge and understanding of users' needs (f)	Understands who the target users are (f)	Makes design simple, user friendly, and easy to use (f)
Participants	9	9	8	8	7
Documents	5	2	2	1	1

Table 2 Frequency of Major Theme

Note. f = frequency

All the eleven documents addressed one or more of the important components of user-centered design strategy and supported the findings from participants. Participants responded with varied contributions that emphasized the importance of user-centered design strategy. Participant # 2 explained, "We incorporate the user, monitor user's behavior and compromise their varying abilities and literacy levels to enable us adopt user-centered design approach". Participant # 3

pointed out that designing ATM system interface for all literacy levels, "involves using the low literate people as the 'skeleton' of the design input because it provided insight into how user-centered design techniques should be applied to this multiple target user groups". According to participant # 7, "user-centered design is subjective; subject to who the users are". Participant #5 emphasized that, to promote adoption of services among illiterate and semi-literate users, who are often among low digitally skilled users, developers should focus on the innovation of the interface design by understanding users' needs. All the nine participants considered having interfaces that all users will perceive as useful and easy to use as one of the major features for the adoption of user-centered design strategies.

One document that specifically contained eighty ATM system interface screen shots that showed the existing interfaces in some banking ATM systems that are not easy-to-use by this study's participants: people with varying abilities and literacy levels. These eighty ATM system interface screen shots supports this study's specific IT problem that some software developers of banking ATM systems in Nigeria are not creating easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. These ATM system interface screen shots, nevertheless, supported this theme because it demonstrates why the interface was not suitable even though it was user-centered, subject to who the intended users were.

Interview findings support the theme and are consistent with TAM's two major determinants PU and PEOU that demonstrate user's attitudes toward a new technology. The finding aligns with studies by Gangwar, Date, & Ramaswamy (2015), Tsai (2015), Conti, et al. (2014), who noted that system developers should consider having intended system users involved from the system design stages to the implementation stage in order to address the two primary predictors for the potential adopter of new technology and two major determinants of TAM: PU and PEOU. Recent studies by Tsai, Chang, Chen, and Chang (2017), and Choi, Rhiu, Lee, Yun, and Nam (2017) support the major theme of this study and are consistent with TAM's two major determinants: PU and PEOU. Also supporting the findings of this study are claims by Paul, Bhuimali, and Chatterjee (2017) that engaging user-centered design strategies is required to address the issue of PU and PEOU of the ATM system interface. Usability design requires a user-centered attitude: knowing the users, the tasks they perform, and developing a product iteratively in a design (Pribeanu, 2017). This, according to Lapao, daSilva, & Joao (2017) also requires incorporating the users' multiple characteristics by way of reinforcing users' ownership of the system, that leads to higher compliance and ease of use of the system by intended users.Also, Paul, et al. (2017) asserted that user-centered design incorporates activities that are concerned and focused on understanding of users' case characteristics that are fundamentally responsible for design and development of easy-to-use system interfaces for the users' case characteristics.

Sheffer, et al. (2017) maintained that the core of good user-centered design is strong application of human factors methodology because it impacts ease of use and easy-to-use of the interface. The recent research ofTaherdoost (2018), noted three main factors that influence the acceptance of technology product: satisfaction, security and quality. These factors are the major determinants of users' attitudes toward a new technology (Gangwar, et al., 2015). Other factors- satisfaction, effectiveness, and, efficiency- are factors that define TAM's PU and PEOU, the two primary predictors for the potential adopter of new technology (Joo, et al., 2014). This theme is consistent with these recent literatures and TAM, the conceptual framework for this study, in that what defines user centered design strategies, is reasonably or logically harmonious with what defines TAM.

Findings from this study show that user centered design strategies encourage developers to create system interfaces that are easy-to-use and influence users perceived usefulness and perceived ease of use of the product. Findings also supported the theme because participants and case organization documents agree to the engagement of user-centered design strategies to actualize easy-to-use ATM system interface. This theme provides one of the answers to the research question of this study.

User-centered design strategy is paramount for the success of creating easy-to-use banking ATM system interfaces that will cater for people with varying abilities and literacy levels in Nigeria.

VI. DISCUSSION AND CONCLUSION

Our purpose in this qualitative case study was to identify strategies software developers of banking ATM systems in Nigeria use to create easy-to-use ATM system interfaces for a variety of people with varying abilities and literacy levels. There is an ongoing need in Nigeria for banking ATM systems that can cater for a substantial proportion of the population classified as illiterate, semiliterate, vision impaired and hearing-impaired users. Banking ATM system interface development technology in Nigeria may experience tremendous innovation if all these disability categories are incorporated into user centered design strategies. The limitations placed on this study, by engaging some relatively small qualified and experienced banking ATM system interface developers from one organization notwithstanding, findings from this study were significant and supported by organizational documents and current literature on user centered design strategies, and consistent with TAM conceptual framework. Therefore, findings from this study should have greater applicability to other developer organizations as well as other IT organizations that are user centered interface technology dependent. The design of an ATM user interface should incorporate both its inherent usability and perceived usability. Easy-to-use banking ATM system interfaces are a major dimension of ATM usability. This usability gap contributed to ATM navigation menus that were not intuitive or as efficient as they should. We argue that since ATM systems are no longer the province of the specialized users, software developers of banking ATM systems must learn to create easy-to-use system interfaces for a variety of people with varying abilities and literacy levels. Developers should be able to simulate users' needs to gather

knowledge about their abilities, limitations, and the most suitable dataset, tools, and techniques in the use of the system. Several researchers are studying ATM system interfaces for a variety of people with varying abilities and literacy levels, but such studies are lacking in Nigeria.

In conclusion, user-centered design strategies can be extended in several directions: First, it can be extended by involving more interface developer organizations by way of considering or exploring multiple case studies to replicate findings across cases and further add to the knowledge base and professional practice among banking ATM system interface developer organizations. Second, it will be interesting to explore user centered design strategies to create easy to use ATM system interfaces that will cater for vision impaired, hearing-impaired, and intellectually challenged users. A study by successful developers with this focus may provide additional insight and allow more users to the ATM system especially among these special users. Also, the findings from this study provide recommendations that there exist opportunities for hybrid approaches to develop strategies to create ATM system interface that additionally cater for these family of disabilities: vision impaired, hearing-impaired, and intellectually impaired users. Third, successful implementation of a transformation in one area has the potential to inform other related areas. User interface developers with strategies to create easy-to-use interfaces in one area can explore and make tremendous impact on other related services, economic restructuring, societal value systems, spread of media technology, and other areas of national interest that are user interface technology dependent

REFERENCES

1. Alfimtsev, A. N., Basarab, M. A., Devyatkov, V. V., & Levanov, A. A. (2015). A new methodology of usability testing on the base of the analysis of user's electroencephalogram. Journal of Computer Sciences and Applications, 3(5), 105-111. doi:10.12691/jcsa-3-5-1.
2. Alshameri, F., &Bangura, A. K. (2014). Generating metadata to study and teach about African issues. Information Technology & People, 27(3), 341-365. doi.:10.1108/itp-06-2013-0112.
3. Bakaev, M. A., & Avdeenko, T. V. (2013). Knowledge-Based System for Web Interface Design. International Journal of Innovation, Management and Technology, 4(1), 38-42.doi:10.7763/ijimt.2013.v4.352.
4. Betab, G., & Sandhu, R. K. (2014). Fingerprints in Automated Teller Machine- A Survey International Journal of Engineering and Advanced Technology, 3(4), 183-186.
5. Bhattacharya, S., & Laha, S. (2013). Bengali text input interface design for mobile devices Universal Access Information Society, 12, 441-451. doi:10.1007/s10209-012-0280-1.
6. Bose, A. J. (2013). Biometric authentication-based ATM machine. National Journal on Advances in Computing & Management, 4(2), 1-4.
7. Burelli, F., Gorelikov, A., & Labianca, M. (2014). ATM benchmarking study 2014 and industry report. ATMIA. Retrieved from http://www.valuepartners.com/downloads/PDF_Comunicati/2014.02-ATMIA-and-Value-Partners-ATM-Benchmarking-and-Industry-report-report.pdf.
8. Caine, K., Kohn, S., Lawrence, C., Hanania, R., Meslin, E. M., & Tierney, W. M. (2015). Designing a Patient-Centered User Interface for Access Decisions about EHR Data: Implications from Patient Interviews. Journal of General Internal Medicine, suppl. Supplement, 30(1), 7-16. doi:10.1007/s11606-014-3049-9.
9. Carter, N., Bryant-Lukosius, D. A., Blythe, J., & Neville, A. J. (2014). The Use of Triangulation in Qualitative Research. Oncology Nursing Forum, 41(5), 545-547.
10. Chen, K., & Chan, A. H. (2013). Use or non-use of gerontechnology-A qualitative study. International Journal of Environmental Research and Public Health, 10(10), 4645-66. doi:10.3390/ijerph10104645.
11. Chen, S., Liu, S., Li, S., & Yen, D. C. (2013). Understanding the mediating effects of relationship quality on technology acceptance: An empirical study of e-appointment system. Journal of Medical Systems, 37(6), 1-13. doi:10.1007/s10916-013-9981-0.
12. Cheng, Y. (2014). Extending the expectation-confirmation model with quality and flow to explore nurses' continued blended e-learning intention. Information Technology & People, 27(3), 258-230. doi:10.1108/itp-01-2013-0024.
13. Chin-Feng, L., Po-Sheng, C., Yueh-Min, H., Chen, T., & Tien-Chi, H. (2014). An evaluation model for digital libraries' User Interfaces using fuzzy AHP. The Electronic Library, 32(1), 83-95. doi:10.1108/EL-05-2012-0046.
14. Choi, I., Rhiu, I., Lee, Y., Yun, M. H., & Nam, C. S. (2017). A systematic review of hybrid brain- computer interfaces: Taxonomy and usability perspectives.PLoS ONE 12(4), 1-35. doi:10.371/journal.pone.0176674.
15. Chu, S., & Tanaka, J. (2015). Design of a motion-based gestural menu-selection interface for a self-portrait camera. Pers Ubiquit Comput, 19, 415-424. doi:10.1007/s00779-014-0776-1.
16. Conti, V., Collotta, M., Pau, G., & Vitabile, S. (2014). Usability Analysis of a Novel Biometric Authentication Approach for Android-Based Mobile Devices. Journal of Telecommunications and Information Technology, 4, 34-43.
17. Coorey, G. M., Neubeck, L., Usherwood, T., Peiris, D., Parker, S., Lau, A. Y. S., … Redfern, J. (2017). Implementation of a consumer-focused eHealth intervention for people with moderate-to-high cardiovascular disease risk: protocol for a mixed-methods process evaluation. BMJ Open, 7(1), 1-10. doi:10.1136/bmjopen-2016-014353.
18. Darejeh, A., & Singh, D. (2014b). An investigation on Ribbon interface design guidelines for people with less computer literacy. Computer Standards & Interfaces, 36(5), 808-820. doi:10.1016/j.csi.2014.01.006.
19. Darejeh, A., & Singh, D. (2014a). A review on user interface design principles to increase software usability for users with less computer literacy. Journal of Computer Science, 9(11), 1443-1450. doi:10.3844/jcssp.2013.1443.1450.

20. Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance. MIS Quarterly, 13(3), 319-340. doi:10.2307/249008 .
21. Dixon, C. S. (2015). Interviewing adolescent females in qualitative research. The Qualitative Report, 20(12), 2067-2077. doi:10.1177/1524839915580941.
22. EFInA (2014). EFInA access to financial services in Nigeria 2014 survey. http://www.efina.org.ng/assets/ResearchDocuments/2014-Documenst/EFInA-Access-to-Financial-Services-in-Nigeria-2014-Survey-Key-Findings.pdf.
23. Etikan, I., Musa, S. A., & Alkassim, R. S. (2016). Comparison of Convenience Sampling and Purposive Sampling. American Journal of Theoretical and Applied Statistics, 5(1), 1-4. doi:10.11648/j.ajtas.20160501.11.
24. Fillion, G., & Ekionea, J. B. (2014). A comparison of the influencing factors of using a mobile phone: Atlantic Canada vs. Cameroon Africa. Academy of Information and Management Sciences Journal, 17(1), 23-154.
25. Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. Journal of Enterprise Information Management, 28(1), 30-107. doi:10.1108/jeim-08-2013-0065.
26. Gangwar, H., Date, H., & Raoot, A. D. (2014). Review on IT adoption: insights from recent technologies. Journal of Enterprise Information Management, 27(4), 502-488. doi:10.1108/jeim-08-2012-0047.
27. Gao, L., & Bai, X. (2014). A unified perspective on the factors influencing consumer acceptance of internet of things technology. Asia Pacific Journal of Marketing and Logistics, 26(2), 211-231. doi:10.1108/apjml-06-2013-0061.
28. Giakoumis, D., Kaklanis, N., Votis, K., & Tzovaras, D. (2014). Enabling User Interface developers to experience accessibility limitations through visual, hearing, physical and cognitive impairment simulation. Universal Access in the Information Society, 13(2), 227-248. doi:10.1007/s10209-013-0309-0.
29. Gonzalez-Vargas, J., Dosen, S., Amsuess, S., Yu, W., & Farina, D. (2015). Human-Machine interface for the control of multi-function systems based on electrocutaneous menu: Application to multi-grasp prosthetic hands. PLOS ONE, 10(6), 1-26. doi:10.1371/journal.pone.0127528.
30. Hanney, S., Greenhalgh, T., Blatch-Jones, A., Glover, M., & Raftery, J. (2017). The impact on healthcare, policy and practice from 36 multi-project research programmes: findings from two reviews. Health Research Policy and Systems, 15(1), 1-21. doi.org/10.1186/s12961-017-0191-y.
31. Hoehle, H., Zhang, X., & Venkatesh, V. (2015). An espoused cultural perspective to understand continued intention to use mobile applications: a four-country study of mobile social media application usability. European Journal of Information Systems, 24(3), 337-359. doi:10.1057/ejis.2014.43.
32. Hoffmann, H., & Söllner, M. (2014). Incorporating behavioral trust theory into system development for ubiquitous applications. Personal and Ubiquitous Computing, 18(1), 117-128. doi:10.1007/s00779-012-0631-1.
33. Hsiao, C., & Tang, K. (2015). Investigating factors affecting the acceptance of self-service technology in libraries: The moderating effect of gender. Library Hi Tech, 33(1), 133-114. doi:10.1108/lht-09-2014-0087.
34. Hyysalo, S., & Johnson, M. (2014). The user as relational entity options that deeper insiginto user representations opens for human-centered design. Information Technology &People, 28(1), 72-89. doi:10.1108/itp-01-2014-0011
35. Ilyas, Q. M., Ahmed, I., & Alshamari, M. A. (2013). Gadget-Inspired Graphical User Interfaces. Journal of Basic and Applied Scientific Research, 3(12), 169-174.
36. Jegede, C. A. (2014). Effects of Automated Teller Machine on the Performance of Nigerian Banks. American Journal of Applied Mathematics and Statistics, 2(1), 40-46. doi:10.12691/ajams-2-1-7.
37. Jimoh, R. G., & Babatunde, A. N. (2014). Enhanced automated teller machine using short message service authentication verification. African Journal of Computing & ICT,7(1), 115-120.
38. Joo, Y. J., Lee, H. W. H., & Ham, Y. (2014). Integrating User Interface and personal innovativeness into the TAM for mobile learning in Cyber University. Journal of Computing in Higher Education, 26(2), 143-158. doi:10.1007/s12528-014-9081-2 .
39. Jung-min, O., & Nammee, M. (2013). Towards a cultural User Interface generation principles Multimedia Tools and Applications, 63(1), 195-216. doi:10.1007/s11042-0121017-0.
40. Kapoor, K., Dwivedi, Y., Piercy, N., Lal, B., & Weerakkody, V. (2014). RFID integrated systems in libraries: extending TAM model for empirically examining the use. Journal of Enterprise Information Management, 27(6), 758-731. doi:10.1108/jeim-10-2013-0079.
41. Kassem, M. A., Mekky, N. E., & EL-Awady, R. M. (2014). An Enhanced ATM Security System Using Multimodal Biometric Strategy. International Journal of Electrical & Computer Sciences, 14(4), 9-16.
42. Kaufmann, C. P., Stämpfli, D., Hersberger, K. E., & Lampert, M. L. (2015). Determination of risk factors for drug-related problems: a multidisciplinary triangulation process. BMJ Open, 5(3), 1-7. doi:10.1136/bmjopen-2014-006376.
43. Kaushik, A. K., & Rahman, Z. (2015). Innovation adoption across self-service banking technologies in India. The International Journal of Bank Marketing, 33(2), 121-96. doi:10.1108/ijbm-01-2014-0006.
44. Kazi, A. K., & Mannan, M. A. (2013). Factors affecting adoption of mobile banking in Pakistan: Empirical Evidence. International Journal of Research in Business and Social Science, 2(3), 54-61. doi:10.20525/ijrbs.v2i3.73.
45. Keates, S. (2015). A pedagogical example of teaching Universal Access. Universal Access in the Information Society, 14(1), 97-110. doi:10.1007/s10209-014-0398-4.
46. Kumar, R. S., Sugavanam, K. R., Gajalakshmi, D., Kumar, S. K., Abirami, V., & Madhavi, R. (2014). Novel vigilant real-time monitoring and Security system for ATM center.

Journal of Theoretical and Applied Information Technology, 64(1), 170-176.
47. Kwan, C. W., Paquette, I., Magee, J. J., & Betke, M. (2014). Adaptive sliding menu bars make existing software more accessible to people with severe motion impairments. Universal Access Information Society, 13, 5-22. doi:10.1007/s10209-013-0295-2.
48. Lapao, L. V., daSilva, M. M., & Joao, G. (2017). Implementing an online pharmaceutical service using design science research. BMC Medical Informatics and Decision Making, 17(1), 1-31. doi:10.1186/s12911-017-0428-2.
49. Ledo-Andión, M., López-Gómez, A., & Castelló-Mayo, E. (2017). The Role of Original Version Cinema into the European Digital Space/El rol del cine en versión original en el espacio digital europeo. Comunicar, 25(51), 73-81. doi.org/10.3916/c51-2017-07.
50. Lin, C. (2013a). Exploring the relationship between technology acceptance model and usability test. Information Technology and Management, 14(3), 243-255. doi:10.1007/s10799-013-0162-0).
51. Lin, C. J., & Cheng, L. (2015). Product attributes and user experience design: how to convey product information through user-centered service. Journal of Intelligent Manufacturing, 28(7), 1743-1754. doi:10.1007/s10845-015-1095-8.
52. Lin, H. (2013b). The effect of absorptive capacity perceptions on the context-aware ubiquitous learning acceptance. Campus-Wide Information Systems, 30(4), 249-265. doi:10.1108/cwis-09-2012-0031.
53. Marshall, B., Cardon, P., Poddar, A., & Fontenot, R. (2013). Does sample size matter in qualitative research? A review of qualitative interviews in is research. The Journal of Computer Information Systems, 54(1). 11-22. doi:10.1080/08874417.2013.11645667.
54. Mccardle, L., & Hadwin, A. F. (2015). Using multiple, contextualized data sources to measure learners' perceptions of their self-regulated learning. Metacognition and Learning, 10(1), 43-75. doi:10.1007/s11409-014-9132-0.
55. Morar, P., Read, J., Arora, S., Hart, A., Warusavitarne, J., Green, J., … Faiz, O. (2015). Defining the optimal design of the inflammatory bowel disease multidisciplinary team: results from a multicentre qualitative expert-based study. Frontline Gastroenterology, 6(4), 290-297. doi:10.1136/flgastro-2014-100549.
56. Morse, W. C., Lowery, D. R., & Steury, T. (2014). Exploring saturation of themes and spatial locations in qualitative public participation geographic information systems research. Society & Natural Resources, 27(5), 557-571. doi:10.1080/08941920.2014.888791.
57. Noyes, J., Hendry, M., Lewin, S., Glenton, C., Chandler, J., & Rashidian, A. (2016). Qualitative "trial-sibling" studies and "unrelated" qualitative studies contributed to complex intervention reviews. Journal of Clinical Epidemiology, 74(1), 133-143. doi:10.1016/j.jclinepi.2016.01.009.
58. Odeyemi, J. O. (2017). Context and Discourse Intonation in English-Medium Product Advertisements in Nigeria's Broadcast Media. i-Manager's Journal on English Language Teaching, 7(2), 13-28.
59. Oh, J., & Moon, N. (2013). Towards a cultural User Interface generation principle. Multimedia Tools and Applications, 63(1), 195-216. doi:10.1007/s11042-012-1017-0.
60. Omari, O. J., & Zachary, O. B. (2013). Investigating ATM system accessibility for people with visual impairments. Journal of Computer Engineering, 15(5), 13-18.
61. Patsiotis, A. G., Hughes, T., & Webber, D. J. (2013). An examination of consumers' resistance to computer-based technologies. The Journal of Services Marketing, 27(4), 294-311. doi:10.1108/08876041311330771.
62. Patton, M. Q. (2015). Qualitative research & evaluation methods: Integrating theory and practice (4th ed.). Thousand Oaks, CA: Sage.
63. Paul, P. K., Bhuimali, A., & Chatterjee, D. (2017). Human Centered Computing: Healthy Gift of Social Engineering for Promoting Digital Humanities: A Short Communication. International Journal of Applied Science and Engineering 5(1), 13-18. doi:10.5958/2322-0465.2017.00002.8.
64. Pribeanu, C. (2014). Extending and refining usability heuristics to better address user centered design issues in the development and evaluation of municipal websites. Informatica Economic, 18(1), 83-91. doi:10.12948/issn14531305/18.1.2014.07.
65. Pribeanu, C. (2017). A Revised Set of Usability Heuristics for the Evaluation of Interactive Systems. Informatica Economica, 21(3), 31-38. doi:10.12948/issn14531305/21.3.2017.03.
66. Ray, S. (2017). A Street Child's Perspective: A Grounded Theory Study of How Street Children Experience and Cope with Grief. The Qualitative Report, 22(1), 291-308.
67. Robinson, O. (2014). Sampling in interview-based qualitative research: A theoretical and practical guide. Qualitative Research in Psychology, 11(1), 25-41. doi:10.1080/14780887.2013.801543.
68. Shaer, O., Valdes, C., Liu, S., Lu, K., Chang, K., Xu, W., Kincaid, R. (2014). Designing reality-based interfaces for experiential bio-design. Personal and Ubiquitous Computing, 18(6), 1515-1532. doi:10.1007/s00779-013-0752-1.
69. Sheffer, J., Hettinger, Z., Lowry, L., Mander, A., Suarez, W., Weinger, M. B., & Wiklund, M. (2017). A Roundtable Discussion: Usability, Human Factors, and Health IT: Providing Effective Guidance While Nurturing Innovation. Biomedical Instrumentation & Technology, 51(3), 252-259. doi:10.2345/0899-8205-51.3.252.
70. Suárez-Guerrero, C., Lloret-Catalá, C., & Mengual-Andrés, S. (2016). Teachers' perceptions of the digital transformation of the classroom through the use of tablets: A study in Spain. Comunicar, 24(49), 81-89. doi:10.3916/c49-2016-08.
71. Taherdoost, H. (2018). Development of an adoption model to assess user acceptance of e-service technology: E-Service Technology Acceptance Model. Behaviour & Information Technology, 37(2), 173-197. doi:10.1080/0144929x.2018.1427793.

72. Teoh, W. M., Siong, C. C., Lin, B., & Jiat, W. C. (2013). Factors affecting consumers' perception of electronic payment: an empirical analysis. Internet Research, 23(4), 465-485. doi:10.1108/IntR-09-2012-0199.
73. Titilope, A. O. (2015). The perception and use of electronic banking among business executives in Lagos state, Nigeria. Greener Journal of Business and Management Studies, 5(2), 47-56. doi:10.15580/gjbms.2015.2.051114389.
74. Tsai, T. H., Chang, H. T., Chen, Y. J., & Chang, Y. S. (2017). Determinants of user acceptance of a specific social platform for older adults: An empirical examination of user interface characteristics and behavioral intention. PLoS ONE 12(8), 1-22. doi:10.1371/journal.pone.0180102.
75. Tsai, Y. (2015). Applying the Technology Acceptance Model (TAM) to explore the effects of a Course Management System (CMS)-Assisted EFL writing instruction. CALICO Journal, 32(1), 153-171. doi:10.1558/calico.v32i1.25961.
76. UNESCO (2015). Data center. Retrieved from http://www.uis.unesco.org/DataCentre/Pages/country-profile.aspx?regioncode=40540&code=NGA.
77. Veletsianos, G., & Shepherdson, P. (2016). A Systematic Analysis and Synthesis of the Empirical MOOC Literature Published in 2013-2015. International Review of Research in Open and Distance Learning, 17(2), 198-221. doi:10.19173/irrodl.v17i2.2448.
78. Visser, L. M., Bleijenbergh, I. L., Benschop, Y. W. M., Van Riel, A. C. R., & Bloem, B. R. (2016). Do online communities change power processes in healthcare? Using case studies to examine the use of online health communities by patients with Parkinson's disease. BMJ Open, 6(11), 1-6. doi:10.1136/bmjopen-2016-012110.
79. Zhang, M., Wang, F., Deng, H., & Yin, J. (2013). A survey on human computer interaction technology for ATM. International Journal of Intelligent Engineering & Systems, 6(1), 20-29.