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An Integrated Theoretical Model for Evaluating Cloud-Based Learning System in Higher Education

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Abstract: The cloud based learning system has the potentials to enhance pedagogical framework, flexibility, collaborations & personalized learning, and resource accessibility for effective teaching and learning in higher education. However, despite the impacts of cloud-based technology in a pedagogical framework, there are there are limited studies that examined the effects of the characteristics of cloud-based learning and other contextual issues on user acceptance within an integrated framework. To address these gaps, this work proposed an integrated model by integrating and extending the unified theory of acceptance and use of technology (UTAUT2) model and IS success model. The paper also discussed the strategy to be employed to validate the model in further research.

Keywords: Cloud-based, learning system, unified theory of acceptance and use of technology, IS success model

I. INTRODUCTION

The use of mobile technologies is increasing nowadays and it provides opportunities for higher educations to utilize mobile applications to enhance pedagogical experiences and increase access to learning resources [4, 6, 18]. The integration of cloud computing and mobile learning allows learners to connect to the internet and use resources online regardless of time and place. Wang and Ng [31] defined four characteristics of cloud-based learning system: storage and sharing, universal accessibility, collaborative interactions, and learner-centered. Storage and sharing provides infinite storage capacity and resources stored over the internet can be shared by different users; universal accessibility allows users across different regions and platforms to access the same data and resources; collaborative interactions enable users to build common knowledge through these interactions; and learner-centered characteristic, means that learners can choose resources that are suitable for them and keep track of their learning progress.

The proliferation of smart mobile devices and higher bandwidth of internet connections have had significant impacts on higher education around the world [5, 7, 30]. Virtual learning environments (VLE) have been deployed by higher education to provide access to learning materials, increase collaborations and as tools for students for over a decade [7, 26]. Nowadays, many learning management systems (LMS) have been developed as cloud-based learning applications to enhance flexibility, collaborations and personalized learning experience[7, 8, 26]. However, despite the capability of this new technology to enhances pedagogical framework in higher education and bring benefits to organization, its implementation sometimes fails due to user's level of acceptance[4, 5 23, 25]. More so, despite the positive indicators of cloud-based technology, there are limited studies on factors influencing user acceptance at educational institutions from multi-dimensions [1, 19]

Researcher studies have focused on the technical aspects of technology and organizational adoptions [3, 6, 21]. However, this work believes that the user behavioral side is more important than the technical aspects in the adoption process. Recent critical review by Kayali, *et al*, [19] factors influencing user acceptance of cloud-based technology revealed that there are lack of studies related to user acceptance of this new technology in educational institutions, and this is the views of Hashim & Hassan [15] and Bayaga [7] and called for more investigative studies.

A number of Studies have developed frameworks to evaluate user acceptance of technologies[11, 15, 25, 27]; however, the researcher observed that these frameworks are limited in scope to provides insight into related factors influence user acceptance of technology to guide decision maker in adoption process. Organization information system are composed of different elements such people, technology, process, task, culture etc [17]. To be able to understand issues surrounding user acceptance of technology, it is necessary to view from multi-dimensions [9, 25, 33]. The earlier models are fragmented and partially explained the phenomenon of user acceptance of the technology. While cloud-based learning is characterized by collaborative, user center, storage and universal accessibility [31], a number of these characteristics have not been examined as for whether they have influences on user acceptance. Furthermore, a number of cloud-based mobile learning implementation have been conducted, however, there are rare studies on the integrated view of these characteristics and learning support to examine as a single model on user acceptance.

The objectives of this paper are to review related technology adoption theories as well as earlier evaluation models in order to develop an integrated model for user technology evaluation.

This paper is arranged into five sections as follows. Section two discussed the theoretical frameworks including related technology evaluation models. Section three discussed the development of the model. Section four presents the proposed methodological approach. Conclusion and further work are discussed in section five.

II. THEORETICAL MODELS

This section reviews relevant literature on user technology evaluation. First, the review on the relevant adoption theories, and followed by the earlier user technology acceptance frameworks.

There are number of models that focused on user acceptance of technology to evaluate a new information system such as the technology acceptance model, the unified theory of acceptance and use of technology (UTAUT2), the IS Success model, and technology task fit (TTF), the theory of Planned behavior and many more relevant theories.

In this paper, we focused on the following related models to address the research problem.

Unified Theory of Acceptance and Use of Technology (UTAUT2) Model

The model believed that the intention or usage of an information system is influencing by the following constructs: performance expectancy, effort expectancy, social influence, facilitating conditions, hedonic motion, price-value and habit [28]. A number of studies have used and integrated this model to developed framework to evaluate user acceptance of technology [15, 16, 25]; despite its wide application, it lacks the inclusion of task & technology characteristics, and organization contexts which the researcher believes are important in addressing issues in user acceptance of technology. The technology should fit into user activities in order to be accepted to achieve organizational objectives [23]. Thus, this model needs to be integrated with other relevant models in order to develop a socio-technical framework for evaluating user acceptance of the technology.

IS Success Model

Information System model by DeLone and McLean [10] got a lot of responses from the researchers since its' development. Among criticisms delivered raised the issue mingling of causal process models and the model built. In 2003, DeLone and McLean updated the previous model. The success of DeLone and McLean Information Systems enter the variables of information quality, system quality and service quality as a determinant of the success of the system information and combine the variables individual impact and organizational impact to be net benefits. This model is useful in studying and evaluating information system. This model can be extended with other models in order to develop user technology acceptance. This model lack user and organizational characteristics which can be integrated with extended UTAUT2 to evaluate user acceptance of cloud-based learning system

Related Works

An evaluation model enhances the understanding and helps to identify critical success factors and the interrelationship among the factors [24, 25]. There are a number of studies that evaluate user acceptance of learning technology, however, the following are related to this work.

Dhulla, Mathur, & Dhulla [11] developed a framework for adopting cloud computing by tertiary level students using UTAUT2 as the theoretical framework. However, despite measuring the impacts of user characteristics, the researcher belief that study only partially examined the factors influencing user acceptance, and that there is a need to extend the framework to include technology and organization characteristics to understand issues surrounding user acceptance of technology.

Yadegaridehkordi, Iahad, & Ahmad [32] used Task-Technology Fit to study user adoption of cloud-based collaborative learning technologies. However, despite measuring the influence of technology characteristics, their study lacks the description and measurement of the learning support, personalized and collaborative learning experiences which the researcher sees could help to understand user acceptance issues in new technology.

Hashim & Hassan [15] developed a framework to study user adoption of cloud computing by extending UTAUT with trust and security. The study found both security and trust as influential factors. However, the researcher belief that lack of technology and organizational characteristics in the framework limits its scope to provide insights into user acceptance of cloud-based learning system.

Tahir, *et al* [27] developed an evaluation model to evaluate cloud storage services among students based on modified Theory of Planned Behavior. Although the model provides user' characteristics to adopt cloud services, however, it didn't examine the effects of learning support, personalized and collaborative learning experiences which the researcher sees are important to provide insight and understanding of issues surrounding user acceptance of the technology.

The earlier evaluation models are limited in scope and insufficient to provide related factors involved in user adoption of cloud-based learning system. They are fragmented and tend to only partially explain the phenomenon of user technology acceptance issues. There is lack of inclusion and measurements of learning support, personalized and collaborative learning experiences in the earlier models which are the inherit characteristics of cloud-based learning system.

Thus the new constructs in the integrated model are discussed in the subsequent sections.

Personalized learning

Mobile learning based on Network can realize personalized learning in the Cloud Computing. Even under these limited circumstances, however, personalized learning presents a solution that may improve learning efficiency. The traditional limitations of time and space of campus are broken through so students can select contents to learn according to their own actual situation at any time at any place. Personalized learning can proceed without hindrance. Learners control and manage individual learning themselves and select needed resources and services for learning [30]. Different learners will select different contents and tools to create their personal learning environments. Essential elements of personal learning environments, such as text, audio and video can be controlled and managed by the cloud service with the support of the Cloud Computing. Unlike traditional teaching methods, web-based instruction methods provide easily adaptable and personalized learning programs through flexible curriculum sequencing control [24]. This allows the learner to take the optimal learning path since every learner has different needs, knowledge level, background, and preferences *etc* [8]. The generated lesson provides the personalized learning experience by customizing learning sequence according to the learners' answers to a questionnaire in the beginning of the lesson. However, there are rare views of this characteristic as whether it has an

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influence on user acceptance of cloud-based mobile learning system.

Collaborative Learning

In the current era, where the world has become a global place, it has become easier to interact with people more frequently than before. This has led to increased diversity in work place and therefore educational institutes now also focus on preparing their students for the diverse environment in the professional world by making them work together in teams and peers. Collaboration becomes an essential competency in the current knowledge society. Collaborative learning is an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and teachers together. Usually, students are working in groups of two or more, mutually searching for understanding, solutions, or meanings, or creating a product.

According to [30], the collaborative work by the students using cloud tools achieved the high success of the process in the specified time while the traditional method achieved low success in the same time. This indicates that collaborative experiences can enhance learners' style and behavioral intention to accept and continue the use of applications. However, there are rare views of this characteristic as whether it has influence on user acceptance of cloud-based mobile learning system

Learning Support

The role and importance of learning support have been addressed in a number of studies concerning information systems implementation. Given the importance of information systems and their role as an organizational resource, support from management, teachers and other stakeholders are crucial in influencing user acceptance of the technology. Learning support from top management support is defined as the degree to which top management understands the importance of the information system functions and the extent to which it is involved in information system activities

Ktoridou [20] design and evaluate cloud based mobile learning using Google Apps for education (GAFE) using the qualitative method and found the challenges of mobile version and support from teachers the factor influence adoption. While, a number of studies have found learning support from management, teachers, technology providers as influential factors, however, within cloud-based system especially at the user level, no such integrated view that examined the effect of this constructs on user acceptance.

III. AN INTEGRATED MODEL DEVELOPMENT

Organization information systems composes of different elements such people, technology, process, culture etc. Hu et al, [17] described acceptance of technology has three contextual characteristics: 'user', 'technology' and 'organization'. Other evaluation models categorized and discussed acceptance of technology at the user level into: user, organization, and technology contexts [1, 9, 23, 25].

The researcher believes that extending the constructs of the UTAUT2 and integrates it with IS success model can produce a better and comprehensive research model for studying user acceptance of the technology. Thus, these two models are integrated together to provide insight into issues in user acceptance of the technology.

This research proposes the integration of the extended UTAUT2 model with IS success model to answer the proposed research questions.

The constructs of the UTAUT2 model (performance expectancy, effort expectancy, social influence, hedonic motion, price value, and habit) are elements belonging to the (individual) user. The facilitating condition from the UTAUT2 model and the extended learning support are categorized within the organization components. Further, the new constructs personalized and collaborative learning experiences are elements of user context. This categorization is shown in table 1 and the definition of the factors is shown in table 2.

Table 1: Evaluation dimensions of technology

Context	Factors
User	Performance expectancy, effort expectancy, social influence, hedonic motion, price-value, personalized learning, collaborative learning
Technology	Information quality, system quality, service quality,
Organization	Learning support, facilitating condition
Moderators	Age, experiences, and gender

Table 2: Definition of the factors in new technology Acceptance Model

Factors/Constructs	Context	Sources
	USER	
Performance Expectancy	The user perceived that the use of the new system will enhance competence.	[28]
Effort Expectancy	Ease associated with using a new system to improve performance	[28]
Social Influence	This is the perception of user on social benefits or perceptions of other in using a new system	[28]
Hedonic Motion	This is pleasured derived from using the technology	[28]
Price-value	This is the cost and benefits that can be acquired. The indicators include an affordable price and suitability of the perceived value.	[28]
Habit	Habit describes the behavior towards a new system or how user behaves toward a new system	[28]
Personalized Learning	The categories of educational programs, learning experiences, instructional approaches, and	[31]

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	support that are intended to address the need of learners.	
Collaboration learning	An educational approach to pedagogy that involves groups of learners working together to solve a problem, complete a task, or create a product in a cloud-based environment.	[31]
TECHNOLOGY		
Information Quality	This measure the quality of information related to new system accuracy, relevance, completeness, and accuracy	[10]
System Quality	This is the quality of new systems related to the display face and the menu features, flexibility, reliability and security systems.	[10]
Service Quality	This refers to system to provide service, technology system and speed in responding to complaints in new system	[10]
ORGANIZATION		
Facilitating Condition	Facilitating conditions are the resources, facilities, and infrastructure available to support users in using the system.	[28]
Learning Support	This is significant to the acceptance of new technology. Support from management, teacher, and providers in terms of available of wireless access, finance, learning process, policies, and innovation, may likely hamper adoption at the user level	[33]
BEHAVIORAL & MODERATORS		
Behavioral Intention, Use Behavior or Behavioral Intention	Behavioral intention also includes desire or intention to use technology.	[28]
Moderating factors	These are factors that improve or decrease efficiency, performance, achievement, satisfaction etc(Experience, age & gender)	[28]

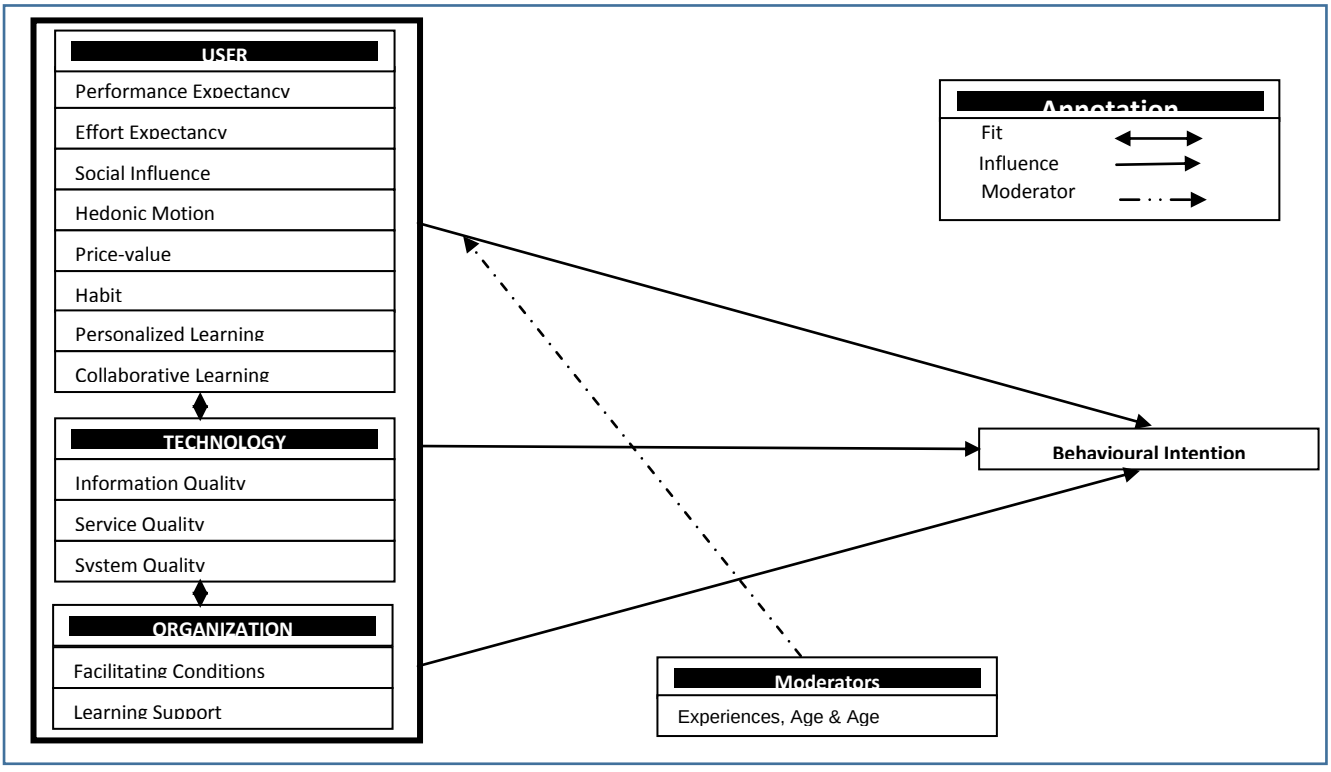

Figure 1: Proposed Integrated theoretical model

The proposed integrated evaluation model from the integration of extended UTAUT2 and IS success model is shown in Figure 1 which presents initial factors that influencing user acceptance of technology in higher education.

From the model, the researcher belief that technology should fit user activities and organizational objectives in which the technology deployed and used. The three dimensions have a direct influence on individual's behavioral intention to accept cloud based learning system.

IV. STRATEGY FOR VALIDATION

The proposed strategy will employ subjectivist case study to validate the proposed model to understand the formative evaluation of cloud-based learning system in higher education. The qualitative strategy will help to understand user experiences in cloud-based learning system environment. The approach will use in-depth interviews and document analysis to validate the model before testing it. To reduce bias, reliability will be achieved through details record keeping of the research process. While triangulation will be achieved through multiple sources of evidence

V. CONCLUSION AND FURTHER RESEARCH

This paper, reviewed the related existing user adoption model and earlier technology evaluation models, and proposed an integrated model for evaluating user acceptance of technology in higher education.

The paper contributed in the literature of information system evaluation and demonstrates its' originality by integrating related theories to develop the novel model to take care of the inadequacies of the earlier user adoption models. This evaluation model will be useful to decision and policy makers, researcher, software and hardware developers to help in the adoption of cloud based system, design and implementation in teaching and learning in higher education. In future, exploratory interview study will be used to validate the model using a case study of higher education in Nigeria.

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