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Application of Orientor Theory for developing a sustainable model for deployment of mobile learning in Kenyan Universities

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Abstract

Today, mobile devices have become a necessary tool in the provision and access to university education across world, including developing countries such as Kenya. While the application of mobile devices and technologies continue to take shape, there is no comprehensive theoretical model that can help institutions achieve sustainable mobile learning. In order to achieve sustainability, this paper investigates the key factors which the orientor theory calls "orientors" that can ensure sustainability. Content analysis was used to analyse the exiting literature. The results of the analysis revealed that numerous factors, namely security, coexistence, adaptability, effectiveness, and existence are inextricably linked to the successful implementation of mobile learning in universities. This research provides a foundation upon which university policy makers and technology developers (vendors) can understand the necessary factors for sustainable development of M-learning applications for adoption in Kenyan universities.

Keywords: **sustainability, mobile learning; technical factors; mobile learning acceptance model; Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology (UTAUT)**

1. Introduction

At the core of M-learning is the ability to provide learning opportunity anywhere and anytime with the help of various mobile devices such as smartphones, personal digital assistants (PDAs) and tablets (Sarrab, 2015;

Uzuboylu & Ozadamli, 2011). Mobile learning is "any educational provision where handheld devices are the dominant technologies. With the proliferation of mobile devices usage in the provision of education, it is becoming increasingly important to focus on understanding the orientors that can influence the adoption of mobile learning (Tsai & Hwang, 2012). The growing acceptance of M-learning applications has led to continued release of devices and mobile learning solutions in educational environments (Sarrab, Al-Shih & Rehman, 2013). For many years now, researchers have come to agree that enterprises are open and dynamic systems (Carlisle & Mcmillan, 2006). This has continued to play an extremely crucial role in overcoming the rigidity and skewed approaches in understanding systems. In this regard, researchers are beginning to take into account the role of the environment and its interactions. This, in the view of many, has the ability to help a researcher gain a deeper understanding of the way systems work within the context of accelerating gains. According to Carlisle & Mcmillan (2006), disruptive technologies, constant growth of new ideas, increasing regulations and the ever-changing learner needs are just but a few areas that must be considered to help model a learning approach that is sustainable (Sarrab, 2015). It is clear that architects of learning technologies need to design models that attempt to optimize its benefits amidst numerous and mutating challenges.

2. Problem Statement

Despite that many studies have been conducted on the effective application of mobile learning, there is lack of knowledge on sustainability of mobile technologies in relation to learning experiences in higher educational institutions. More research needs to be done to establish a more robust, comprehensive variable that can be incorporated in developing a sustainable mobile learning strategy. By conducting further research in this area, researchers will gain a deeper understanding of some of the technical factors that should be considered when leveraging the power of mobile learning technologies (Schneider and Matthes, 2014). Despite the advancements in mobile learning technology, there are still limitations that affect the development of a viable model for application (Schneider and Matthes, 2014). Several universities in Kenya and abroad have incorporated m-learning into their learning and teaching environments but continue to face numerous challenges that affect their effort to effectively use mobile technologies (Burger, 2013).

There have been efforts towards achieving sustainable models for deployment of m-learning. There are numerous studies that have attempted to develop a theoretical approach for sustainable mobile learning in schools and universities. While such studies provide a starting point of developing a sustainable model for m-learning, the available models have only focused on adoption and individual components, especially the learners, instructors, which are components of a subsystem of the whole system. Some of the hindrances of proposed models include security, adaptability, existence, coexistence and effectiveness. Because the existing models are not grounded on the system sustainability factors, it is crucial to investigate the above factors and their applicability to designing a sustainable mobile learning system in the context of university education in Kenya (Gnauc, 1998; Burger, 2013).

3. Literature Review

3.1 Overview of Technology Acceptance Models and Theories

Many researchers have employed varied technology acceptance models, including Technology Acceptance Model (TAM) developed in 1989, Unified Theory of Acceptance and Use of Technology (UTAUT) developed by Venkatesh et al. in 2003 all of which have focused on user intentions and behavior as the core constructs (Cheng, 2019). TAM consists of four reflective factors; --performance expectancy, effort expectancy, social influence, and facilitating conditions. On the other hand, Cheng (2019) contents that the popular model known as UTAUT, was developed based on eight theories, namely, the theory of reasoned action (TRA), theory of planned behavior (TPB), combined TAM and TPB (C-TAM-TPB), innovation diffusion theory (IDT), model of PC utilization (MPCU), and social cognitive theory (SCT).

UTAUT was found to be more robust than most of the previous according to recent reviews between 2010 and 2020 (Cheng, 2019). However, all of the models focused on the users experiences with the technology, which is not sufficient for a sustainable model. Sustainability refers to the ability of a model or application to address the current needs of the users without threatening the needs of the future generation of users (Sarrab, 2015; Kim et al., 2017).

3.2 Overview of Orientor Theory: Orientors and their Implications for M-learning Management

According to orientor theory systems orient towards six core environmental aspects namely, scarce resources, normal state, variety, evolution and variance among others. In this paper, the researcher focuses on mobile learning application landscape, its infrastructure as well as various parties interacting with the system. The theory proposes that at the core of any model and decision process are the orientors. The following section delves into the orientors that underpin the orientor theory and how the influence viability and sustainability of m-learning architecture.

3.31 Existence

This orientor refers to the normal state of environment in which a system is thought to keep its state variables the same to allow them to function under ideal conditions. To work effectively, the existence orientor requires a buffer to keep the system protected from all manner of risks that are likely to disrupt the normal behaviour of the system. What this means is that in a bid to apply mobile learning technologies, safeguarding the application landscape ensures no disruptive behaviour. In order to ensure the framework works efficiently, all stakeholders need to be involved in AL design decisions (Lucke, Krell, Lechner , 2010). This orientor has many IT capabilities, including IT service management, monitoring capability.

3.32 Effectiveness

The effectiveness orientor focuses on the scarcity of resources within the application environment and how such resources can be preserved. In any case, resources need to be apportioned reasonably and used efficiently. To ensure preservation of the environment and resources, planners and policy makers need to consider time, budgets and knowledge. The application system should consider efficient acquisition of scarce resources by incorporating subsystems and their connections. According to a study conducted by Schneider & Somers (2006), knowledge acquisition through deploying educators, policy experts and instructors can be pretty challenging, particularly considering the ever-evolving field of mobile learning. As an operational rather than strategic concept with far-reaching implications, stakeholders need to continuously balance their efforts to ensure the processes and applications are as efficient as possible (Lucke, Krell, Lechner, 2010).

Everyone involved in a program is always hoping to achieve the best outcomes. For this reason, the better the ratio of efforts to outcomes the more the system orients itself towards effectiveness. But does the ratio have to be perfect? It is not possible to keep the system in a perfect state. However, for effective functioning, it is necessary to maintain a positive ratio on average over time. Therefore, mobile learning management for effective implementation of mobile learning is completely inevitable (Lucke, Krell, Lechner, 2010).

3.33 Adaptability

The adaptability orientor lends itself to the evolving nature of the application environment. A system that is not ready to adjust to the threatening influences risks delivering its results to the users. Ideally, systems ought to adapt either their behaviour or their inherent structure. What this means is that changes to the system in order to cope with the developments in the industry can result into a system that is explicitly different from the initial one (Wingkvist & Ericsson, 2009). Therefore, to change the application environment or the structure can have far-reaching implications to the viability of the system. Institutions looking to cope with the evolving and dynamic mobile learning technologies need to consider the kind of impact such changes are likely to cause if they have to realize the goals of their programs (Wingkvist & Ericsson, 2009). On the other hand, changing the behaviour is more appropriate since it is a co-evolution. This strategy can be the best, especially if the environment is experiencing small changes. However, this adaptability requires that the agents have a fairly high degree of organization. Strictly speaking, behavioural changes can only take place under the following conditions: -- versatility of the system, variety within the structure, decentrality of the system and some degree of autonomy.

Based on the adaptability orientor, a system would require a modular architecture that features loosely linked applications, technologies and data components that provide an opportunity to set standards (Ross, 2003). Any learning institutions that intends to make its application environment versatile and inclusive should build its foundation by deliberately accepting the functional redundancy. Because adaptability orientor requires the ability to learn, knowledge management becomes critical. To achieve this, organizations need to foster an open and flexible structures capable of supporting the adaptivity orientor (Cheng, 2019).

3.34 Security

The security orientor relates to temporal variables that provides a buffer to prevent the system from unnecessary harmful influences. What this means is that any system or model needs to be immune or at least free from interference from external factors. It should operate independently and based on the stable environmental factors. This can be achieved by cushioning against any overloads and bypassing any supply gaps. This can be done through establishing self-regulating structures capable of neutralizing any potential threats. Mobile learning application environments relying on the security orientor would go an extra mile to equip its workforce (teaching staff, IT experts and students) in order to overcome likely market supply gaps. In order to set up a self-sustaining structure, institutions should be ready to establish a robust monitoring and governance capability. This would go a long way in helping to defuse any potentially harmful threats. Establishing resource buffers such as virtual servers will help to protect against request overloads. The implementation matrix would be incomplete without a risk management and continuity management support in order to make real the benefits of the security orientor.

3.35 Coexistence

While a majority of studies on coexistence have focused on human conflicts, its basic tenets, which include diversity, tolerance to each other and avoidance of conflicts can be applied in other fields. Coexistence is an interaction with a commitment to tolerate, mutual respect, and the acceptance to amicably resolve conflicts without unnecessary recourse to violence (Nyawira, 2003; Weiner, 1998**)**. In any application environment, chances are that multiple systems or models exist. in this case, it is likely that one or more other models can influence the system being piloted or implemented. Therefore, before going ahead to fully implement any learning model, it is essentially important to consider the behaviour and interests of other applicable systems for the good of the system (Nyawira**,** 2003**)**.

Ordinarily, every single influence from the external environment comes with an ‘unsystemic’ component alongside an opposing behaviour featuring other models. Because a specific system is often of great interest, such a system occupies a crucial position in the coexistence orientor. This requires that any system develops the ability to realize that other systems can cause disruption to a greater extend. Being aware of the ongoing strategic

moves such as the need to build a system that is scalable to accommodate the growing number of users allows such a model to adjust itself to the environment in which it operates. For the coexistence orientor to make sense, sensors and analytics capabilities are needed (Cheng, 2019).

As technologies hit the market, a common question arises among IT teams—Should we built, buy or keep to what we have? Whether it is hardware, software or both, implementing a cutting edge technology comes with a cost. Deploying a new platform for learning involves a lot of things, including creating awareness to stimulate acceptance training employees and huge investment in physical infrastructure and more (Kadirire, 2009). While institutions may be prepared to meet a majority of these challenges, the problem that continues to wreak havoc is the inability to create IT harmony that hinders organizations to innovate without causing disruption.
Implanting new technologies while keeping the old ones intact, is often a challenging endeavour. The ability of any entity to keep the existing relational database intact, while at the same time transitioning to a completely new technological dispensation is why defines sustainability of the system (Cheng, 2019).

In order to achieve sustainability, it is crucial to test coexistence between emerging technologies and existing. IT teams are faced with the possibility that the most crucial data and the IT resources crucial to various users cannot be accessed, something that is common when trying to transition to a new end-to-end solution. In order to ensure a smooth transition without being at crossroads on whether to choose the old or new, institutions of learning need to leverage the capabilities of both platforms where new technologies can sync well with old technologies to benefit the users (Cheng, 2019). The growing number of wireless standards presents challenges of interoperability of various mobile learning technologies. As more and more applications are added to the already crowded spectrum, users face the problem of interference between various technologies separate frequency spectrum to individual standards. Interference between applications can not only cause an outage capable of losing data but also create a security vulnerability. The answer to these challenges lies in coexistence testing. Perhaps it is the single most important steps that any IT product developer can take to ensure stable, reliable and smooth interactivity between devices and software applications that can thrive in the real world.

Coexistence testing during the design of any application technology is useful in determining the device's tolerance to others to guarantee its operability, even when other devices or technologies are used (Cheng, 2019). This goes a long way in helping the developer to identify any potential interference so as to mitigate any potential threats before it goes into real use. The critical point to make here is that while interference is an everyday reality, especially when it comes to technology, unexpected failure of the device or application to interact with others can have far-reaching consequences (Cheng, 2019). It can erode the users' confidence, seriously degrade the developer's image and may mean recalling the product. Therefore, product developers can rely on coexistence testing to ensure that whatever devices they are releasing will work seamlessly, regardless of the environment in which it will be used.

Many theories have focused on interactivity between devices and while this is necessary, it is not sufficient to address the inherent challenges that go beyond interaction between devices, users and administrators. Aside from interaction, system components need to coexist or work harmoniously while tolerating each other in order to deliver the expected outcomes (Cheng, 2019). Therefore, coexistence guarantees that system components will not only link up but also ensure that such components move along. Ideally, coexistence a more robust, inclusive concept that goes beyond the ordinary interaction.

3.3 Application of Orientor Theory in Modelling Mobile Learning in Universities

Mobile technologies are arguably some of the fastest growing areas in the field of learning and curriculum delivery. For learners, mobile learning technologies provide a more robust and appealing means through which to access learning that would otherwise be difficult. With such technologies, learners are able to access a variety of information sources anytime anywhere. While it is agreeable that the pace of adopting mobile learning in education has gained momentum in the last decade, many scholars feel that there is still no concrete view on the best way to sustain the practice to guarantee success from the opportunities being explored (Cheng, 2019). Sustainability is a complex yet crucial concept not only in mobile learning technologies but also other fields. It is becoming increasingly necessary for institutions of learning to tale deliberate steps to invest substantially in training and initiate learning programs. The complexity of developing a sustainable mobile learning is further

exacerbated by the growing dynamics in the digital technologies that present mixed possibilities and challenges. What's more, educators, policy makers and other stakeholders in the education sector are still trying to reconcile traditional learning models with technology-driven learning. Further, and most importantly, many theories have been developed and applied to help implement mobile learning in schools and universities, but little research has been directed towards a theory for sustainable practice of mobile learning.

This paper explores the orientor theory and goes further to examine its applicability in developing sustainable mobile learning models that can leverage the growing opportunities of mobile learning. Presenting insights on orientor theory and its practicability in developing a sustainable model, this paper will prove incredibly beneficial to educational policy makers, instructors and management teams in Universities wishing to make real the gains of mobile learning technologies.

Orientor theory is undoubtedly one of the most effective approaches that have been applied in ecology and economics (Cheng, 2019). The theory and its proponents have demonstrated just how orientors can be used to establish a deeper and robust understanding of the innate behaviour of application landscapes from a holistic view taking into account the environment in which they operate. While the theory has been popularly applied and successfully so in the fields of ecology and economics, its basis and point of take-off finds a lot of coherence with learning application platforms. It provides not only a conceptual integration of various aspects of relevant application in the field of education (Cheng, 2019).

Grounded on its strong understanding that agents with a deeper understanding of the system behaviour helps to arrive at better decisions, the application of orientor theory can be a promising tool to help model mobile learning technologies. Based on the assumption that policy makers with an inner understanding of the system behaviour make logical decisions the application of orientor theory certainly becomes a crucial tool to model the behaviour of system architectures. Finally, the researcher concludes the paper by detailing a conceivable road-map for designing of a sustainable application landscape in the context of complex mobile learning environments (Schneider & Somers, 2006).

As outlined before, the intention of applying the orientor theory is to extend the scope of the already existing models in order to move towards achieving holistic outcomes. A review of the literature between 2010 and 2020 has shown it is limited in addressing complex and dynamic aspects of enterprises (Gnauck, 1998). Therefore, this research employs orientor theory as a basis to create viable systems in the context of mobile devices and the application landscape design. According to Bossel (2001), orientors refer to a "set of criteria that are crucial for evaluation of any system". While the orientor theory has its origins traced in ecological studies, it has been used widely in describing complex systems in other fields.

4. Significance of Orientor Theory in M-learning

4.1 Application of Orientor theory in Landscape Decisions

The application of basic orientors is a way of dealing with conditions in which the status of the system is not agreed upon by system designers. Because of the overwhelming number of stakeholders in the planning, policy and decision-making processes that influence the application landscape, numerous views should be considered. In systems, especially where technologies keep changing on a daily basis, a single objective solution cannot be guaranteed (Gnauc, 1998). For this reason, orientors provide the most appropriate condition that can be applied in judging the sustainability of mobile learning technologies. Ordinarily, decisions involving application landscapes (AL) aimed at transforming actions take place in boardrooms where agents converge, the application of orientors and their dichotomy can go a long way in establishing a shared view among the decision agents. The shared problem understanding has the effect of facilitating the development of priorities and helping those involved to stay focused on the benefits of implementing IT capabilities (Ross, 2006).

What's more, orientors provide a fertile ground on which strategic guidance for sustainable decision-making can be grown. By using orientor theory, policy makers are able to navigate the delicate balance between varied interests thus ensuring system viability. Further, the application and modelling of basic orientors not only allows for an objective assessment of the system states but also understand the opposing views. This way, different views are brought together to allow different factions to agree upon the desired orientors upon which the system should be developed (Bossel, 2001). Based on the foregoing, a framework for mobile learning that is established

using the orientors can allow for concrete strategic modelling. Therefore, orientor theory, although deeply rooted in ecological studies can find application in mobile learning enterprises in which adaptation, sustainability and coherence are key.

4.2 **Interaction of Systems and Subsystems Using the Orientors**

In the preceding sections the researcher has outlined how orientor theory could be applied to model the application environment for m-learning within a complex environment. Because the theory is relevant in supporting design and implementation of systems, institutions and vendors of mobile applications need to choose which orientors are appropriate for their application landscape. The relationship between systems and subsystems need to not only interact but also coexist for sustainability. The orientor theory is built on the assumption that a system's sustainability largely driven by the sustainability of each subsystem (Cheng, 2019). For viability of any model, it is important for the system components to orient more towards the effectiveness while the components in each of the subsystems have to orient more towards being more adaptable owing to the rapid changes in the mobile applications and devices (Cheng, 2019).

5. Conclusion

In this paper, the researcher demonstrated why there are gaps in the theories to the extent that they fall short of necessary insights needed to provide a holistic approach in developing a sustainable mobile learning model. While the researcher is completely aware that the Orientor Theory has not been widely applied in the learning and teaching field, it is worthwhile noting that the orientors, which are at the core of the theory makes a lot of sense insofar as their applicability is concerned. Like any other application environment, the mobile learning environment does not operate in a vacuum. Instead, there are certain underlying orientors that would make the system or model remain viable. Therefore, it is justifiable to link the orientors to the existing mobile learning approaches in order to develop a more coherent framework capable of living on. In each of the orientors, the researcher has demonstrated the implications for mobile learning landscape and outlined how an M-learning model could apply the orientor theory for its sustainability. Additionally, it has demonstrated that the application

of the six orientors has an overarching influence on the viability of the model. However, in order to underpin the applicability of the proposed theory, researchers need to check the application in reality. If the theory is to be applied to effectively model an m-learning model, concrete measures need to be defined to make each of the orientors applicable. For example, it is important to use domain-specific orientors such as those capable of modelling behaviour in the context of application landscape.

While a few studies have delved into the application of mobile learning in universities, their application in a complex and evolving systems have proven challenging. Consequently, it is important to assess the sustainability of learning development processes before applying any such theory. Fortunately, this is the raison d'être of Orientor Theory; it provides a means through which to assess the sustainability of the economic systems, even though it has been done on a rather abstract level. Using the systems and Orientor theory, this paper generates suggestions for criteria of creating a sustainable mobile learning system. In Bossel's observation, ensuring the viability of a system is synonymous with maintaining its sustainability. This is only possible if the system is able to adapt to the changes within the environment in which it is being applied. According to the original application of the Orientor Theory, sustainable development of the economy is thought to comprise of four core subsystems (population, society, natural environment and other economies (Schneider and Matthes, 2014). The theory argues that sustainability of the economy should not threaten the sustainability of the system it interacts with.

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