

Trends in Mobile Learning Research in sub-Saharan Africa: A Systematic Literature Review

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ABSTRACT

Given the flexibility and ubiquity brought about by mobile learning (m-learning), many learning institutions have adopted m-learning to ensure efficiency and effectiveness in teaching and learning. Catalysed by COVID-19 protocols such as social distancing and lockdowns, m-learning is gaining a lot of ground in Africa. As a result, several m-learning deployment models and strategies have emerged. Although many studies have been conducted in this domain, there are still no global models and best practices that guide implementation of m-learning especially in resource-constrained contexts. This study employs a systematic review and interpretive approach to collate the key body of knowledge in m-learning design and implementation over the past 10 years in sub-Saharan African (SSA) countries. Comparison with m-learning practice in the developed world, as a barometer to ascertain the advancement of m-learning practice in the developing world, with a particular focus on sub-Saharan Africa was also undertaken. The results show that m-learning research is predominantly undertaken in South Africa and Nigeria with only a few other countries engaging in such research. However, most of the studies were not grounded on solid theoretical frameworks and empirical findings. Moreover, this study found that the Technology Acceptance Model is the most used theoretical framework. Most studies on m-learning have relied on surveys as the most preferred data collection tool. These findings contribute towards knowledge creation at levels of theory and practice by highlighting the extant knowledge, and gaps that could inform future m-learning research.

Keywords: *mobile learning; mobile devices; sub-Saharan Africa; Systematic Literature Review.*

INTRODUCTION

Information and Communication Technologies (ICTs) are possibly the most fundamental drivers shaping contemporary society, transforming various spheres of life such as commerce, government, political participation, and education. In recent years, Africa has recorded the fastest ICT adoption in the world (Issahaku, Abu & Nkegbe, 2018). No technology has spread faster throughout the continent than mobile phones (Rumanyika, Tedre, Mikko & Mramba, 2019). The rapid growth in the usage of mobile devices has led some scholars to state that 'mobile phones have become...another one of their [individuals'] limbs' (Gezgin, Hamutoğlu, Sezen-Gültekin & Yıldırım, 2019, p. 734). Scholars like Donner & Gitau (2009) have described Africa as a mobile-centric continent. It is projected that sub-Saharan Africa (SSA) will remain the fastest growing region in its mobile subscriber base until 2025, with a Compound Annual Growth Rate (CAGR) of 4.6% (GSMA, 2019). It has been argued that human beings have evolved from Homo Sapiens to Phono Sapiens, that is, beings who cannot live without their mobile phones (Park et al., 2017). Park et al., (2017) further stated that in the 'Phono Society,' Phono Sapiens can be connected to billions of their fellow netizens, with unlimited access to voluminous information. Mobile phone technologies have made information that was previously difficult to produce and disseminate much easier to access and transmit (Issahaku, Abu & Nkegbe, 2018; Karim, Darus & Hussin, 2006).

ICT innovations have been used in different socio-economic establishments to solve societal problems or mitigate challenges. With the proliferation of research in mobile devices, several domain areas have emerged, such as m-agriculture, m-finance, m-banking, m-commerce, m-

government, m-health, and m-learning (Imran, Quimno & Hussain, 2016). The research suggests that there is a realisation amongst African scholars and policymakers that mobile technologies have the potential to transform the infamous “dark continent”, through the provision of affordable access to educational information resources, or m-learning. UNESCO (2019) estimates that reading via mobile devices could be up to 500 times cheaper than reading literature in a physical format. Furthermore, mobile technologies contribute towards the realisation of the United Nations Sustainable Development Goal 4 (UN SDG 4); ensuring inclusivity and equitable means to a quality education, and the promotion of lifelong learning opportunities for anyone that wants access (Montiel, Delgado-Ceballos, Ortiz-de-Mandojana & Antolin-Lopez, 2020). Although not a silver bullet, mobile technologies are a welcome opportunity to improve access to educational information in sub-Saharan Africa, which has the highest learning information exclusion rates in the world (UNESCO, 2020).

While the use of mobile devices in the context of m-learning has gained prominence, it has faced a myriad of challenges (Hashim, Tan & Rashid, 2015), many of which remain under-researched and under-theorised (Kaisara & Bwalya, 2021). To better illuminate such challenges, a Systematic Literature Review (SLR) may be useful in uncovering the extant breadth and trends in m-learning research. A SLR is the art and science of identifying, selecting and synthesising primary research studies to provide a comprehensive and trustworthy overview of the topic being studied (Crompton, Burke, Gregory & Gräbe, 2016). Scholarly reviews are lauded for shaping the future of research and practice through their ability to look deep into a particular topic, thereby providing a new vantage point (Alexander, 2020). Due to the novelty of mobile technologies in learning, it has been noted that there is a paucity of literature that reviews trends in m-learning (Crompton, et al., 2016), including in Africa. This study seeks to illuminate the current trends on m-learning in sub-Saharan Africa, as well as the extant gaps that warrant further research.

PREVIOUS STUDIES

In this section we briefly provide an overview of previous review studies in the m-learning literature, with a view to providing a basis for comparisons. Systematic literature reviews are also helpful in identifying pertinent issues in a given body of knowledge. Several scholars have conducted SLR on m-learning, in varying contexts, and different times.

Kaliisa & Picard (2017) conducted a systematic literature review of m-learning studies in Africa published in the period 2010 to 2016. They noted that although there was a paucity of empirical studies in Africa, the field of m-learning continued to grow. Krull & Duarte (2017) examined m-learning studies of 233 papers, focusing on papers written between 2011 and 2015. Their study analysed research themes, methods, technologies, and settings in m-learning within higher education institutions globally. However the study reviewed papers focusing on countries such as the United States of America, Taiwan, United Kingdom, Spain, and Turkey, among others. In a systematic literature review that assessed various elements of m-learning such as research purposes, methodologies, outcomes and contexts of studies, Crompton & Burke (2018) found that only 3% of the studies in the review had their foci on African countries. This compares poorly with Asia (50%), North America (21%), Europe (13%), and Oceania (13%) (ibid). Although mobile devices offer great opportunities for enhanced access to educational information, studies on m-learning in the African continent are limited. Consequently, the conditions necessary for the integration of mobile devices in learning in the African context are not always understood.

Previous studies have unearthed invaluable insights for practitioners and researchers. However, the limited evidence of m-learning review papers in the African context presents a danger for African stakeholders, as conclusions may be drawn from studies that are based in the global North. It is, therefore, apparent to us that more scholarship focused on the African context is needed.

Whilst Kaliisa & Picard (2017) focused on the whole African continent, this study was limited to the sub-Saharan context.

Consequently, the main objective of this paper is to survey the extant literature on m-learning in sub-Saharan Africa. The motivation behind this focus was to understand the level of penetration of m-Learning within the education sector in the region. Therefore, this study sought to identify the various methodologies and frameworks that inform current research. More precisely, this study sought to answer the following research questions; 1: Where in sub-Saharan African countries was research on m-learning conducted? 2: What theoretical frameworks underpin the selected studies? 3: What research designs were used? 4: Who are the respondents in the selected studies? 5: What variables were measured in the reviewed papers?

In attempting to answer the above questions, this research intends to contribute to future research prospects by identifying gaps in the existing literature. The proliferation of mobile devices in the region necessitates a critical discussion on the appropriateness of using traditional ICT adoption models. As aptly noted by Tsarwe & Mare (2020), when discussing the transformational value of mobile devices, there is need to desist from unmitigated euphoria and uncritical glorification that often emanates from technological determinists.

SYSTEMATIC LITERATURE REVIEW

This section outlines the details of the literature review search and selection criteria and the papers included in the review basket. The literature review process was underpinned by the following research question: What is the status of m-learning research in sub-Saharan developing countries? The review process was guided by Okoli's (2015) systematic literature review framework. Table 1 provides an overview of the review mapped against Okoli's framework.

Table 1: Systematic Literature Review Framework (Okoli, 2015)

SLR Steps	Activity
Step 1 Identify the purpose	The authors sought to provide an in-depth analysis of theoretical frameworks and methodologies that underpin m-learning studies in sub-Saharan countries. Through this process, the study inevitably identifies gaps that exist in literature.
Step 2 Draft protocol and train the team	<ol style="list-style-type: none"> 1. A research question was formulated, discussed by the authors, and refined to ensure conciseness and clarity. 2. A protocol was drafted to guide the authors during the SLR process.
Step 3 Apply practical screen	<p>This involved deciding what would be considered for review. To qualify for inclusion, m-learning papers needed to have been;</p> <ol style="list-style-type: none"> 1. published in peer reviewed journals or conferences 2. written in English, 3. focused on the sub-Saharan context, 4. be of an empirical nature, and 5. published in the period 2010 to 2020.
Step 4 Search for literature	An extensive literature search was conducted, through Google scholar, ERIC, EBSCO, and other library databases, using keywords such as "m-learning", "developing countries", "research methodologies", "theoretical frameworks", "sub-Saharan Africa."
Step 5 Extract Data	The researchers extracted information that spoke to the criteria specified in Step 3.

Step 6 Appraise quality	The researchers examined all the papers at our disposal to evaluate their quality. However, quality is a subjective issue. Consequently, the researchers applied the conditions stipulated in Step 3 to ascertain quality.
Step 7 Synthesise studies	At this stage, the authors aggregated pieces of information from different papers, and the findings were subsequently tabulated.
Step 8 Write the review	A discussion of the findings, and their implications for research, is provided.

FINDINGS

Paper Selection

Using the inclusion criteria in Table 1, the initial article search yielded 115 articles. Through further consultations between the researchers, duplicates, papers that reported on broader e-learning, and those which did not qualify as conference or journal papers were removed. Through an iterative consultative process, the researchers continuously refined the papers against the criteria outlined in Table 1, until 26 papers remained. The resultant 26 papers underpin the analysis in this paper.

Countries where the research was conducted

In this section the researchers sought to establish where the research was conducted, and not the author(s)' affiliation. Of the papers reviewed in this study, South Africa emerged as the country with the highest number of studies (9), followed by Nigeria (7). These findings mirror the findings of Kaliisa & Picard (2017), whose study focused on literature published between 2010 and 2016. Perhaps, it is worth noting that the two countries are the largest economies in the African continent. This is unsurprising, given that scholars such as Docampo & Bessoule (2019) have established that there is a relationship between a country's research output and its wealth, although the causal relationship between the two is still a subject of debate. This review also found that some studies transcended national boundaries, for example, one focused on the East Africa region, whilst another focused on Uganda and South Africa. The researchers categorised these studies as "international".

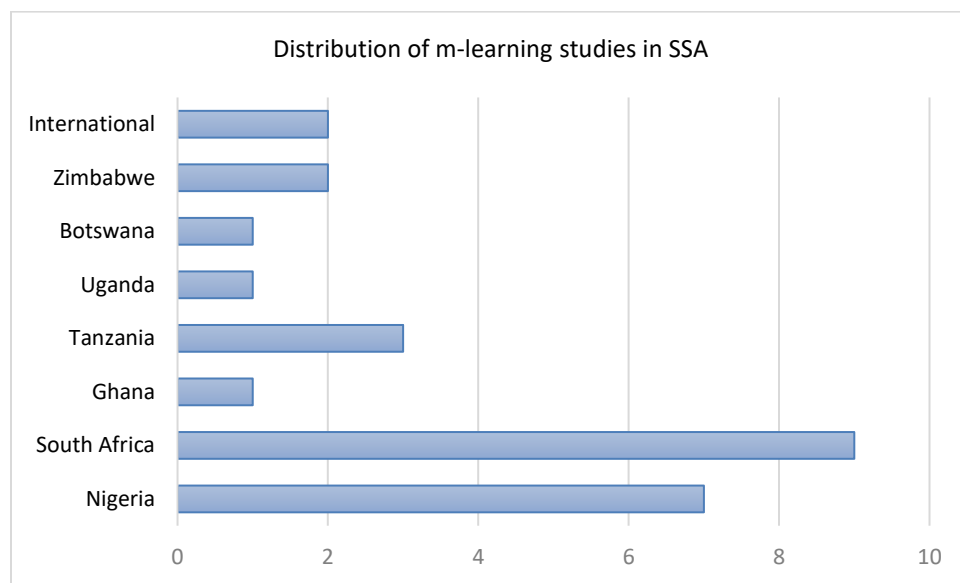


Figure 1: Country spread of m-learning research in SSA

Use of theoretical frameworks

Table 2 shows the theoretical frameworks that underpin the various articles that were analysed in this study. This analysis was important as scholars ascribe great importance to the use of theoretical frameworks in scholarly research. Scholars such as Kaliisa & Picard (2017) argued that results and conclusions of studies that are not based on a theoretical framework are questionable. They posit that in the absence of a theory, society's understanding of the world could be meaningless

Table 2: Theoretical frameworks reviewed

Theoretical Framework	Authors
Unified Theory of Acceptance and Use of Technology (UTAUT) [2]	Ajayi, Ayo & Olamide (2019); Chaka & Govender (2017); Mtebe & Raisamo (2014)
Critical Theory of Technology, Design Science Research (DSR), and Connectivism	Ghasia, de Smet, Machumu & Musabila, (2018)
Technology Acceptance Model (TAM)	Bere & Rambe, (2013); Matyokurehwa, Rudhumbu & Mlambo (2020); Petersen (2020); Scholtz & Kapeso (2014);
Conversation Analysis Theory	Ngaleka & Uys (2013)
Actor Network Theory	Paledi (2019); Paledi & Alexander (2018);
Behaviour Model and Activity Theory	Sibanyoni & Alexander (2018)
Theory of Planned Behaviour	Tagoe & Abakah (2014)

Of all papers reviewed, only 13 papers (listed in Table 2) utilised a Theoretical Framework. This finding is consistent with the results of a systematic literature review undertaken by Kaliisa & Picard (2017), which found that only 14 out of the 31 reviewed articles employed a theoretical framework. Furthermore, the systematic literature review by Krull & Duart (2017) revealed that, of the 233 articles analysed, only 101 utilised any theoretical framework. This is even though the Information Systems/Information Technology/Information Communication Technology (IS/IT/ICT) field has a rich tapestry of theoretical frameworks owing to its history of drawing on theories from other domains such as economics, management, and psychology (Wade & Hulland, 2004).

Research designs

This section discusses the methodological trends associated with m-learning research in the reviewed articles.

Table 3: Research designs

Research design	Authors
Qualitative	Ghasia, De Smet, Machumu & Musabila (2018); Ngaleka & Uys (2013); Paledi (2019); Paledi & Alexander (2018); Rambe & Bere (2013); Sibanyoni & Alexander (2018);
Quantitative	Ajayi, Ayo & Olamide (2019); Azeez & van der Vyver (2018); Bere & Rambe (2013); Chaka & Govender (2017); Ebiye (2015); Ifinedo, Kankaanranta, Neittaanmäki & Hämäläinen (2017); Matyokurehwa, Rudhumbu & Mlambo (2020); Mtebe & Kondoro (2016); Mtebe & Raisamo (2014); Mubuke, Kituyi & Ogenmungu (2016); Oriogu, Ejemezu & Ogbuiyi (2018); Oyelere, Suhonen, Shonola & Joy (2016); Petersen (2020);

	Shonola, Joy, Oyelere & Suhonen (2016); Tagoe & Abakah (2014)
Mixed Method	Mahenge & Sanga (2016); Maketo (2018); Mupfiga, Mupfiga & Zhou (2017); Scholtz & Kapeso (2014); Ssekakubo, Suleman & Marsden (2013);

As shown in Table 3, most of the scholars adopted a quantitative research design, followed by qualitative, and mixed methods. These designs accounted for 58%, 23% and 19% of the studies respectively. Given that positivism, which is the philosophy anchoring quantitative studies, has historically been the most dominant philosophy in Information Systems research (Coombs, 2017; Dubé & Paré, 2003), the adoption of quantitative designs is unsurprising. Quantitative research designs indicate a propensity to test the applicability of existing concepts and theories in new contexts, whilst qualitative designs tend to seek to unearth new phenomena (Turnbull, Chugh & Luck, 2020).

Population of study

Our findings indicate that 79% of the reviewed papers had students as their target population. This aligns closely with the findings of Krull & Duarte (2017), whose review study found that 78% of studies across the world had a target population comprised of students. Hence, we can deduce that sub-Saharan research trends in m-learning mirror global trends. Perhaps this is unsurprising, given the fact that some scholars such as Al-Emran, Mezhuyev & Kamaludin, (2018); and Thongsri, Shen, Bao & Alharbi (2018) argued that the success of an Information System is to a great degree influenced by end users' acceptance and use of the system. Furthermore, our study found that 21% of studies targeted a combination of respondents. These included students and academic staff (Ebiye, 2015), academic staff, administrators, and IT personnel (Mahenge & Sanga, 2016; Paledi & Alexander, 2018), lecturers, students, ITS directors, and librarians (Mupfiga, Mupfiga & Zhou, 2017).

Data collection methods

Surveys were by far the most widely used data collection approach. Forms of surveys employed included descriptive surveys (Ebiye, 2015) and online surveys (Bere & Rambe, 2013; Petersen, 2020; Ssekakubo, Suleman & Marsden, 2013). Online surveys are increasingly gaining popularity due to their ability to access unique populations such as virtual communities, to reach a wider population in a relatively short time, as well as being relatively cheaper than traditional paper-based surveys (Wright, 2005). Further, Wright (2005) noted that in some instances online response rates have been found to be better than traditional mail surveys. However, the disadvantages associated with online surveys include difficulty accessing online communities, and sampling issues such as self-sampling bias (Wright, 2005). In this review, the researchers found that some studies employed a combination of various data collection techniques. The researchers observed that all but one (namely, Ebiye, 2015) of the studies that targeted different types of respondents (as opposed to one demographic) employed a combination of two or more data collection strategies.

Variables measured

Earlier, the researchers stated that students were the largest respondent demographic among the studies reviewed. It is therefore logical that most of the studies were centred around students' perceptions and experiences with m-learning. Only two studies sought to develop a form of framework to guide m-learning implementation: Scholtz & Kapeso (2014) sought to propose a theoretical framework for m-learning for Enterprise Resource Planning (ERP) systems, while Mubuke, Kituyi & Ogenmungu (2016) using participatory design, undertook to develop a model to enhance students' intention to adopt and use m-learning.

GAPS IDENTIFIED AND WAY FORWARD

This review study identified several gaps in the extant literature, some of which were flagged by earlier review studies. The researchers put forward these gaps as potential research areas that could inform various forms of ICT/IS/IT research, particularly in the context of sub-Saharan Africa developing countries.

Although the research designs seem adequately distributed, the findings suggest a need for more variety in the methods used given the different contexts in which m-learning is conducted. Particularly, the researchers advocate for more scholars to adopt Grounded Theory in their studies, as it is grossly underutilised. In Krull & Duart's (2017) findings, only 1 percent of the qualitative studies reviewed used Grounded Theory. In this review, it was found that only Ghasia, et al. (2018) adopted Grounded Theory principles. This is despite the well-documented advantages of grounded theory such as developing theories and providing rich descriptions of a particular phenomenon. Academic gatekeepers would no doubt welcome less adoption and testing of frameworks from the Global North in developing country contexts, to facilitate the decolonisation of knowledge, and counteract the persistently high failure rates of technology interventions in the developing world. Further, some scholars such as Matavire & Brown (2008) argued that the tendency of the ICT/IS/IT discipline to adopt theories from other disciplines diminishes its authority as a strong discipline, as well as eroding the theories' strength. Grounded Theory offers scholars an opportunity to develop theories rooted in the local context or confirm existing theories through rich contextual data.

A significant number of the reviewed studies were focused on South Africa and Nigeria. This is even though Africa is a continent of 54 countries, with most of these countries in the sub-Saharan Africa region. Evidently, there is a need for more scholarship contributions from other African countries, as experiences in the relatively developed South African and Nigerian contexts cannot be used to represent the SSA context. Drawing conclusions from a few affluent African countries and generalising those findings as representative of the whole continent is problematic, owing to the diversity of socio-economic conditions in sub-Saharan Africa. Consequently, there is a need for contextually based m-learning models that are grounded in local data, as opposed to universalistic models that attempt to view Africa as a homogenous locale.

The propensity of m-learning scholars to use students, whilst yielding invaluable data, might be presenting a skewed picture. Students are generally consumers of a product (m-learning services), and oftentimes their first contact with the system occurs after development and deployment. In this study, we found that only a few scholars (Mahenge & Sanga, 2016; Mupfiga, Mupfiga & Zhou, 2017; Paledi & Alexander, 2018) engaged various stakeholders such as staff, ICT experts, librarians, and academics in their studies. It is important that scholars consider the contributions of various stakeholders since the overall success of m-learning systems is a multi-stakeholder effort.

While the use of mobile devices in the context of m-learning is gaining prominence, it has faced a myriad of challenges (Hashim, Tan & Rashid, 2015). One such challenge is the challenge of immature and scarcely reported theoretical underpinnings (Aguayo, Cochrane & Narayan, 2017; Baran, 2014; Imran, Quimno & Hussain, 2016; Liu, Han & Li, 2010). Consequently, as scholars pay more attention to the potential of mobile devices in various spheres, it is pertinent that traditional ICT adoption methodologies, and theoretical frameworks be critiqued in relation to mobile devices. Scholars such as Liu, Han & Li (2010) have raised questions on the appropriateness of traditional ICT adoption models like the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT) to inform m-learning adoption.

CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to review the extant m-learning literature, with a particular focus on sub-Saharan Africa. The spread of the highly communicable COVID-19 virus, and the ubiquity of mobile phones in Africa` has reignited interest in ICT mediated learning such as m-learning. Evidence from this study suggests that there is a need for more m-learning research in Africa considering that the current body of knowledge is dominated by literature from continental powers such as Nigeria and South Africa. More studies from poorer and less developed sub-Saharan African countries are needed. Furthermore, there is a need for more contextually grounded theories to emerge from the sub-Saharan context, rather than simply adopting and testing theoretical frameworks developed in foreign contexts. Questions have been raised about developing theories in one context and attempting to simply fit them into another context. According to Davison & Martinsons (2016) “the assumption that we can achieve theoretical convergence and generate genuinely universal findings is naïve and even irresponsible” (p. 247), They argued that this viewpoint ignores the context and boundary conditions that influenced the original instantiation of a given theory, as well as the unique indigenous constructs where the theory is being tested. This position is increasingly being shared by some Information Systems Journals. For example, in its aims and scope, the Electronic Journal of Information Systems in Developing Countries (EJISDC) states that:

...we discourage authors from submitting papers that merely test well-worn theories developed in the Western context. We note that many authors take a well-established theory (such as TAM, UTAUT, ISSM, TPB) and unreflexively collect data from a developing country in order to test if the theory/model also applies in that context. These authors typically do not try to situate the theory/model in the new context at all - few or no local contextual details are provided and we learn very little about the local context.

Source:<https://onlinelibrary.wiley.com/page/journal/16814835/homepage/productinformation.html>

The findings reveal that students' perceptions towards m-learning was the variable most widely studied. Consequently, there is also a need to conduct more research that looks beyond student perceptions of m-learning. This may involve finding ways to elicit feedback from various stakeholders such as educators, policymakers, and instructional designers. Furthermore, more research is needed focusing on issues such as the development of m-learning implementation frameworks, as implementation precedes use. This study also identified the gaps in the extant literature and proposed potential focal areas for future m-learning research.

LIMITATIONS OF THE REVIEW

The limitations of this paper, as with many review papers, is the possible exclusion of other papers that might have additional and relevant data. However, due to time and other resource constraints, it is impractical to attempt to exhaustively review all extent literature. Another limitation of the study was the fact that the researchers only reviewed studies published in English, yet sub-Saharan Africa has several French and Portuguese speaking countries. This might have introduced some level of bias where equally relevant research that might have been conducted in languages other than English was possibly omitted. Consequently, the results presented in this paper might not necessarily be mutually exclusive in as far as representativeness is concerned. Other scholars may adopt other strategies, such as bibliometric studies, to unearth salient matters in the m-learning discipline. The researchers believe that this paper has at the very least, highlighted the need for further discussions on the research trends in the m-learning domain in the developing world. As aptly noted by Sharma & Kitchens (2004), the uniqueness of m-learning brings about a myriad of changes in content, pedagogy, and classroom practices. In conclusion, the researchers borrow

from Montiel, et al. (2020), who stated the need for new ways of seeing things to balance various needs and successfully problem solve.

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