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THE ADOPTION OF AN M-LEARNING POLICY IN HIGHER EDUCATION: THE PROFESSIONALS' PERSPECTIVE IN DEVELOPING COUNTRIES

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ABSTRACT

In this digital age, e-learning has developed rapidly from web-based searches to mobile learning. This study aims to identify an M-learning policy for high schools in developing countries. An expanded theory of planned behavior framework, comprising the core constructs and the additional variables of enabling environment and experience, is employed to predict the significance of adopting M-learning among learners. The data is collected via social media and emails, and analyzed using Smart PLS-SEM 3.0. Of the 205 students completing the questionnaire, 38.5% were male and 61.5% female. The results indicate a satisfactory R^2 of adoption intention (0.157) for all the variables and moderator, and the school setting is significant for the adoption of an M-learning policy; thus, it is suggested that government policy is a crucial factor to its acceptance in any learning setting. The ubiquity of mobile devices is unavoidable, and an innovative approach could lead to the effective application of this technology in education. A government policy will encourage and strengthen such effectiveness among scholars in developing countries.

Contribution/Originality: This study contributes to the existing literature and discourse on M-learning with the intention to use the innovation in schools, due to learners' experience of with the technology in high schools. M-learning complements e-learning and ICT in driving development in many socioeconomic endeavors for developing economies, especially the subregions on the African continent.

1. INTRODUCTION

In the age of technological innovation, most activities and resources are tailored toward information and communication technologies for development (ICT4D) (Kabanda and Brown, 2017). The novelty of mobile learning technology in education shapes today's students in an informal setting, but is challenging for different sociocultural environments (Peeters *et al.*, 2014). This technology comprises any learning innovation based on a flexible and portable handheld device acting as an interface to information and knowledge (Li, 2016) thus, M-learning, or learning while on the move, is accessible from wireless-enabled personal digital assistants (PDAs), smartphones, iPads, tablets (Mehdipour and Zerehkafi, 2013). Recent guidelines from UNESCO highlight the current behavior of learners in higher education, the significant role of an M-learning policy, and that almost every student owns a mobile device in most developing countries (West and Vosloo, 2013). Studies have identified a larger scale of informal M-learning, which is a concern for policymakers and stakeholders enhancing and transforming educational

technology in high schools and colleges among low-income economies (Karimi, 2016; Osakwe *et al*., 2017). Concerns raised by scholars are related to the reliability of the technology and its impact on education; thus, many educationalists and researchers should chart the technological innovation principles of UNESCO.

With the current cloud environment, the digital age facilitates learners' and professionals' use of information communication technology via a mobile device (Quaye, 2015). Study undertaken through hypertext and social network learning environments, though, is a whole new pedagogy for some teachers who adopt the expertise approach (Serrano-Laguna *et al*., 2014). Studies on the process, strategic implementation, and evaluation of mobile learning utilization is based on professionals and authorities in schools (Sung *et al*., 2016; Khan *et al*., 2018). Findings reveal that students' behavior in using smartphones empowers student-centered learning, which in turn enhances cognitive ability to undertake inquiry-based and discovery learning (Pegrum *et al*., 2013; Kabanda and Brown, 2017). The sociocultural misconceptions and perceptions about M-learning technology should be resolved through enlightenment. However, the ability of teachers and learners to integrate teaching methods with the technological innovation of M-learning is only achievable through regulatory legislation, which itself requires the appropriate environment and cultural understanding of the concept (Osakwe *et al*., 2017). The adoption of an M-learning policy requires a stepwise approach to resolve specific educational bottlenecks: infrastructure, e-reading, ICT, e-learning, and the logistic need of schools, at a cognitive level (Dedrick *et al*., 2013). The same principles apply to an ICT implementation policy, although it is the learners themselves who invest in M-learning. Previous studies have examined the skills and experiences of the learners using mobile devices and suggested ways to facilitate technological innovations in schools (West and Vosloo, 2013).

Moreover, mobile devices are often used outside the classroom for sharing knowledge and for informative learning. Despite their role as a learning catalyst in higher education, in most developing countries, such as Ghana, Nigeria, Sierra Leone, Cameroon, and Rwanda, mobile devices are banned in schools. Nevertheless, the concern of professionals is not simply from a fear of being sidelined; empirical evidence shows there is a responsibility to ensure the safe use of mobile devices, which is essential for an efficient and effective implementation framework (West and Vosloo, 2013). UNESCO research has shown such a ban on mobile devices causes more harm than good: due to the ubiquity of mobile devices, the formal education system must adopt these innovations to enhance efficient student-centered education in the achievement of study goals (Ireri and Omwenga, 2016). Indeed, studies have found that the use of M-learning in schools better helps students discover and understand the meaning of words than in the classroom (Looi *et al*., 2014). On the other hand, the professionals' perspective of the technology is respected, and teaching methods should be regulated (Kimiloglu *et al*., 2017). Hence, the aim of this study is to encourage the regulated use of M-learning in schools, to stimulate student-centered learning in an informal setting (Sung *et al*., 2016). Research findings from personalized accounts of stakeholders and professionals reveal most individual users of M-learning are given the freedom to learn without instructors or other assistance (Yagci, 2015). By enabling student-learning activities in schools, M-learning supports the setting of assignments and exercises (Beutner and Rüscher, 2017). The adoption of the technology is not retrogression but progression; therefore, rules and regulations for M-learning implementation are essential for the prosperous socioeconomic and educational development of low-income countries (Sobaih *et al*., 2016).

Furthermore, Brahimi and Sarirete (2015) argue that technology consists of networks, instructors, and learners, both inside and outside schools, that contribute to the success of learning and knowledge acquisition, and positive attitudes toward M-learning (Brahimi and Sarirete, 2015). M-learning as a complement to distance education has aided the affordability of learning (Park, 2011) many research studies accept M-learning as a subset of e-learning, which has long been in use in developed, although not necessarily developing, countries (Al-alak and Alnawas, 2011). A study of the potential of M-learning and its ability to streamline technological assessment, providing immediate feedback on all activities to learners and teachers, demonstrates a novel application of technology that efficiently automates the distribution, collection, and evaluation of assignments and associated

documentation (Wongwatkit *et al.*, 2017). This research study will empirically analyze: (1) the policy of adopting M-learning in higher education, including the professionals' perspective in developing countries; (2) how a technological policy will effectively support academic performance in high schools of developing countries.

1.1. Background Study to M-Learning Policy

Recently, mobile learning (M-learning) has become a crucial study tool among educationalists and professionals in learning institutions (Sayibu *et al.*, 2018). The assimilation of modern technological innovations among learners has introduced a different aspect, which has affected a breakthrough in policy: ICT is increasingly becoming a significant tool in teaching and learning, one example of which is the use of WeChat, a social media tool, by Chinese students to share lecture materials and relevant resources (Yagci, 2015). The rapid growth of ICT originated with the use of mainframe followed by desktop computers in the 1970s, leading to the development of tablets and then smartphones (Castillo and Ayala, 2012).

"We cannot always build the future for our youth, but we can build our youth for the future."

Franklin D, Roosevelt, September 20, 1940, Address at University of Pennsylvania

With changing marketing/educational trends, today's learners are being educated for jobs with different strategic technological innovations; thus, the above quotation remains important in advocating the need for public policy on M-learning and other technologies in education. The rapid growth in creative technological ideas and shaping young people for the future requires social consciousness (Castillo and Ayala, 2012). Academic institutions are far more resourceful with technology than previously, particularly in terms of mobile connectivity, which is key to sustainable improvement in educational reorganization and restructuring (Abu-Al-Aish, 2014). The features and smooth implementation of mobile technology have provided a significant breakthrough for the educational system: learners now have new experiences in schools, quite different from the past (Bird and Stubbs, 2015).

In 1954, Skinner (1971) forecasted the use of technology in education. His teaching machine, a very early and unwieldy computer, was similar to today's mobile technology in revolutionizing classroom learning for students: they were given the opportunity to learn independently using targeted, self-paced lessons. Skinner's predictions anticipate the modern-day computers, netbooks, and other technologies, but why did it not succeed in 1954? The innovation of mobile technology is quite different and peculiar to today's educational setting. The concept of computers in schools was a dramatic change and made little progress in the educational context; Skinner's teaching machine was a novelty that made only a minimal contribution to the traditional classroom setting. Since then though, computers have developed and transformed, becoming smaller and more effective and efficient, which has enabled their rapid adoption in the classroom. Computers were first used in education for data storage in the 1960s. Eventually, in the 1980s, the Apple II mainframe computer became available worldwide. Then, the teaching of ICT, during K12 education predominantly, expanded in the 1990s. The need to connect all classrooms to the internet was realized with the emergence of desktop computers, laptops, and netbooks, while Apple released its iPad in 2010 (Levy, 2015). The introduction of the tablet computer stimulated the further innovations of touchscreens, increased portability, Wi-Fi, and intuitive user interfaces (Drigas and Pappas, 2015).

While the iPad signaled a significant change in digital learning, other Android-based tablets developed, resulting in Acer and Asus entering the market in 2013 as the top netbook producers. Although difficult to imagine, the widespread use of tablets and all their functions, despite some misapplication, has grown without any calls for public policy or regulations. With technological changes over a period of 60 years ending in a handheld device that fits in the user's pocket, M-learning technology has enhanced teaching and learning for most teachers and learners (Burden and Kearney, 2017). In fact it is currently the most promising technology as a learning tool; therefore, a policy is crucial for embedding its use in education (Borrás and Edquist, 2013). Mobile technology will enable personalized learning on the move, a change that will revolutionize the education system. In the significant words of Gates (2009):

"The world of education is the sector of the economy so far the least changed by technology. Ten years from now that won't be the case."

Now we are in the 21st century, smart implementation of mobile technology and a progressive educational policy can lead the way to M-learning (Crompton, 2013). The above quote can therefore be seen as calling on legislatures "to think outside the box," because the potential of mobile devices as learning tools will not cease.

1.2. Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB) originally evolved from the theory of reasoned action (TRA) (Songer-Nocks, 1976); (Fishbein and Cappella, 2006) which had been used to examine behavior in relation to the adoption of information systems (Ajzen, 1991). This is only one of many psychological models for predicting behavior that is employed in this study. Conceptually, TPB comprises several independent antecedents: behavioral intention (BI), attitude toward behavior (ATB), subjective norms (SN), and perceived behavioral control (PBC). *ATB* is the assessment of intended action or events, which is positive or negative when executed (Ajzen, 1991): The attitude of learners and teachers in schools suggests a strong desire for the adoption of M-learning. *SN* refers to users' perception of social laws, norms, and attitudes that could determine whether an action, such as regulatory measures for teachers, is accepted, by school authorities for instance (Ajzen, 1991). *PBC* is the users' belief of how easy or difficult an action will be to perform: if the school authorities facilitate the implementation and use of M-learning, then its adoption is more probable (Ajzen, 1991). Therefore, an M-learning policy must take into account users' PBC to benefit from its positive influence on attitudes, culture, authority, beliefs, and SNs. The adoption of technology is also easily affected by expectations, perceived usefulness (PU), and perceived ease of use (PEOU), but these extended factors are not included in this study (Venkatesh *et al.*, 2003).

1.2.1. Expanded TPB Framework

The existing model of TPB (ATB, SN, PBC) is expanded for the adoption of M-learning in higher education by means of enabling environment (EE) and experience as moderator (Ajzen, 1991; Wada, 2018). *Enabling Environment* is the physical or social setting that enables knowledge acquisition in a tranquil atmosphere (Noar and Zimmerman, 2005). In this context, the environment, people, and behavior are intertwined, of which the last, although in the background, Noar and Zimmerman (2005) can determine learners' adoption of M-learning in school. *Experience as moderator* refers to learners' exposure to technology, the skills and knowledge acquired over time, and the sense of purpose in using mobile devices (Crogman and Trebeau Crogman, 2018) thus, the learners' use of M-learning in school can create a playful learning environment in which learners are motivated to engage and learn unconsciously (Kangas *et al.*, 2017). Such covert use of mobile devices by learners over a long period greatly influences their adoption of M-learning, enhancing its efficiency. Experience as a moderator expresses the author's observation as a professional teacher of learners' attitudes toward using mobile devices and demonstrates an undoubtedly positive effect (Yen *et al.*, 2017).

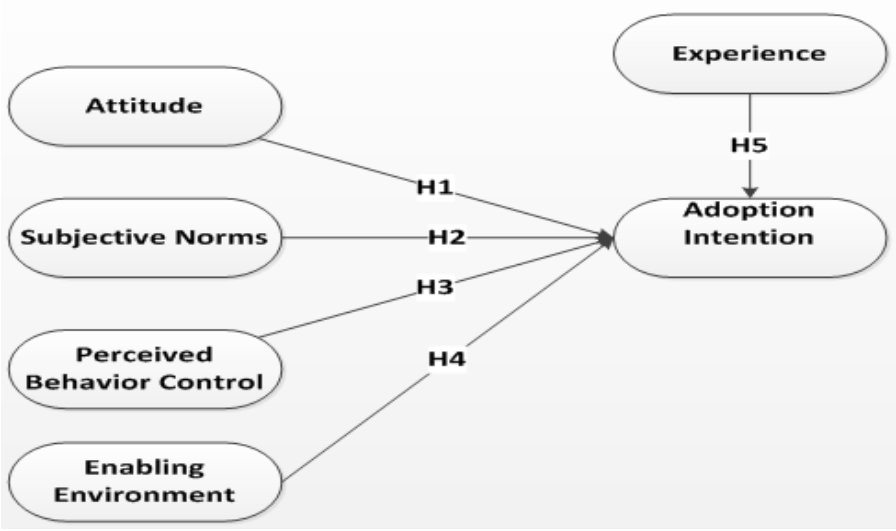

Figure-1. Conceptual Model of M-Learning using TPB Theory.

1.2.2. Hypothesis

H1: Attitude toward Behavior (ATB) positively influences the adoption intention (ADIN) for an M-learning policy in education.

H2: Subjective Norms (SN) are strongly related to the adoption intention (ADIN) for an M-learning policy.

H3 Perceived Behavioral Control (PBC) is strongly related to the adoption intention (ADIN) for an M-learning policy in higher education.

H4: Enabling Environment (EE) may be positively or negatively associated with the adoption intention policy for an M-learning in education.

H5: Experience (E2) moderates adoption intention (ADIN) to enhance the adoption of a policy.

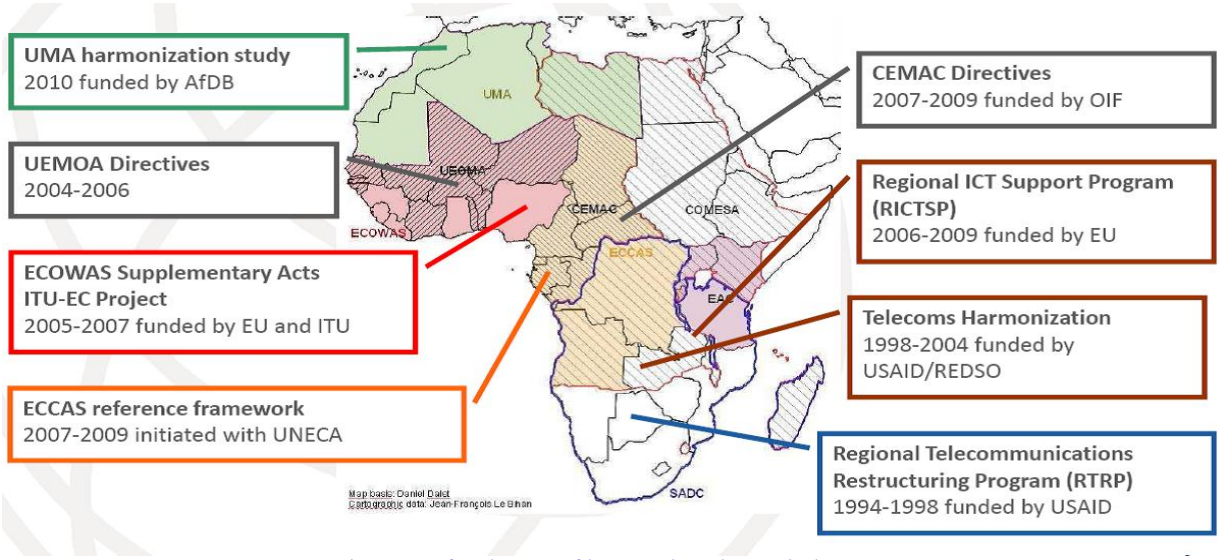

Figure-2. Subregions on African Continent in Developing ICT.

Source: African Page for Development.

2. METHODS AND MATERIALS

2.1. Study Aims

The author employed TPB in a triangulated approach, modified to investigate M-learning adoption through data and theory. A web-based questionnaire was created with Google (Levy, 2015) with each construct measured quantitatively by a 5-point Likert scale—ranging from (1) strongly disagree (SD), (2) disagree (D), (3) undecided (UD), (4) agree (A), to (5) strongly agree (SA) (Likert, 1932); Osakwe *et al.* (2017)—while qualitative means were

used to collect demographic variables (Beglar and Nemoto, 2014). A stratified sampling technique was employed to select target participants: primary educationalists, and teachers and students in high schools, colleges, and universities (Venkatesh *et al.*, 2003). Due to the interest in mobile learning, the research was undertaken via social media: a link to the questionnaire was randomly sent to students and teachers via WhatsApp and WeChat between January 2 and 29, 2018, with most teachers using it as a class assignment. A total of 255 participants were approached, of whom 205 responded (an 84.5% response rate). Seven high school teachers with expertise in ICT emailed the author personally to indicate their previous experience of using M-learning in some lessons, even without any policy. In fact, the majority of respondents were from high schools across developing countries, which were within this study's target population. Of the 205 respondents, 126 were female and 79 male, 79% and 38.5%, respectively; Table 1 details the other demographic variables of age, educational level, region, and how long and how often (weekly, monthly, annually) they had used mobile phones.

The questionnaires were carefully and critically constructed in line with adoption of an M-learning policy. The model depicted in Figure 1 indicates the dimensions that streamline the various developmental needs for the key ICT component; the expanded TPB framework was the most appropriate for the questionnaire survey, including not only ATT, SN, PBC, and ADIN but also EE and E2.

2.2. Model Measurements

To assess the goodness of fit for the structural model, partial least squares structural equation modeling (PLS-SEM) (Hair *et al.*, 2013) was applied to the endogenous construct of adoption intention. To assess the validity and reliability, composite reliability (CR), convergent validity, and discriminant validity (Hair *et al.*, 2013) were calculated. Where the CR lies between 0 and 1 and logical validity between 0.7 and 0.9, validity and reliability can be assumed satisfactory (Rönkkö and Ylitalo, 2011). Construct validity and reliability, plus average variance extracted (AVE) were also calculated: a loading higher than 0.70 on its respective construct indicates reliability (Hair *et al.*, 2012a) the value of AVE should be ≥ 0.5 (Fornell and Larcker, 2016), meaning a latent variable should be able to capture at least 50% of each indicator's variance (Yen *et al.*, 2017). Cronbach's α was used to measure the internal consistency reliability, which should be ≤ 0.70 for each latent variable (Hair *et al.*, 2013). Finally, the discriminant validity, according to Fornell–Lacker's criterion, will confirm whether the latent variables are distinctly different from one another (Hair *et al.*, 2012a).

2.3. Structural Models

To measure the structural model, the values of R-squared (R^2), effect size (Cohen's f^2), path coefficients (t-value), Q^2 predictive relevance based on blindfolding, and collinearity were determined (Hair *et al.*, 2013). According to Bodoff and Ho (2016) R^2 values of 0.19–0.33, 0.33–0.67, and ≥ 0.67 indicate low, moderate, and strong explanatory power; Hair *et al.* (2013) explained Crohn's f^2 values of 0.02, 0.15, and 0.35 as weak, moderate, and strong effects; Aimran *et al.* (2017) emphasized that $Q^2 > 0$ indicates that the path model's predictive accuracy is acceptable. In calculating Q^2, the author adopted the cross-validated redundancy approach. Collinearity was assessed using the variance inflation factor (VIF), which is important because path coefficient estimates may be biased if collinearity is present (Henseler *et al.*, 2015) a VIF value of ≥ 5 implies a potential collinearity issue (Hair *et al.*, 2012a).

2.4. Data Analysis

Descriptive statistical analyses of the demographic information related to the adoption intention for an M-learning policy in developing countries were undertaken using IBM SPSS v.23.0 (IBM, Armonk, NY, USA). The reliability and validity of the variables in the models were measured and tested, following reliability analysis principles to validate Cronbach's α. On the whole, a coefficient value of ≥ 0.70 (Mcneish, 2017) is acceptable for

Cronbach's α (IBM, 2015) in some analyses related to TPB (Bonett and Wright, 2015); (Xie *et al.*, 2017). Table 1 shows the mean, mode, median, and standard deviation (SD) employed in a comparative study of gender, educational level, age, region, and the period of time that the sample population (N = 205) had used advanced mobile phones (smartphones), to assess adoption intention. A mixed methodology of qualitative and quantitative data for triangulated studies was adopted for robust validity and reliability.

3. RESULTS

3.1. Respondents' Characteristics

As mentioned in the previous section, 205 responses—including 7 emails form those with educational ICT expertise in developing countries—were received from a total of 255 questionnaires, representing an 84.5% response rate (61.5% female vs. 38.5% male). The high response rate can be explained by the online status of the target population and the interest among teachers, who assigned the task during ICT lessons via WhatsApp and WeChat, social media in common use among students.

Table-1. Demographic variable analysis.

Variables					Mean	Median	Mode	SD
		N	%	TOTAL				
Gender	F	126	61.5	205	1.39	1.00	1	0.488
	M	79	38.5					
Education SHS/NON	SHS 1 SHS 2	63 95	30.7 46.3	205	1.97	2.00	2	0.828
	SHS 3	37	18.0					
	NON	10	4.9					
Age	18–25yrs	172	83.9	205	1.22	1.00	1	0.539
	26–34yrs	21	10.2					
	35–45yrs	12	5.9					
Region	WA	19	9.3	205	5.91	6.00	8	2.723
	ASM	8	3.9					
	PAH	10	4.9					
	WR	26	12.7					
	ER	15	7.3					
	IND	25	12.2					
	CRA	24	11.7					
	NRA	49	23.9					
	UA	18	8.8					
	BAG	11	5.4					
Period of Use	1-2yrs	2	1.0	205	3.99	4.00	4	0.099
	>2yrs	203	99.0					
Frequency of Use	Yes	205	100	205	1.00	1.00	1	0.000
	No	-	-					

Note: SHS, senior high school; WA, West Africa; ASM, Asia China Main; PAH, Pakistan Region; WR, Western Africa; ER, Eastern Africa; IND, India Region; CRA, Central Africa; NRA, Northern Africa; UA, Western Region Africa; BAG, Bangladesh.

Teachers took the time to explain the instructions for and purpose of the questionnaire. A Cronbach's α value of 0.740 was generally calculated for all variables: the majority of respondents were 18–25 years' old (N = 172, 83.9%), attained the highest educational level (SHS 1–3; N = 195, 95.1%), had used mobile phones for two or more years (N = 203, 99.0%), and frequently used advanced smartphones (N = 205, 100%). Thus, this study conforms with the survey by Africa Internet Tracking Progress that found 72% of young people in developing countries were mobile users (Ghana Statistical Service & Ghana Demographic Health Survey, 2008).

3.2. Model Measurements

In the path analysis, the lowest CR value is 0.53 for SN, which is statistically satisfactory. Table 2 indicates the loadings range from 0.828, 0.813, 0.778, 0.685, 0.547, down to 0.526 for ADIN, ATB, E2, EE, PBC, and SN, respectively; only EE indicates a very low correlation. Furthermore, it can be seen from Table 2 that the weakest AVE in the study is again for EE at 0.489, which is slightly below the threshold value of 0.5 suggested by Claes and David (2012). Similarly, Cronbach's α, which measures internal consistency reliability, exceeds 0.70 for all the latent variables (Hair *et al.*, 2013) whereas the AVE ranges from 0.489 to 1.040, which is a clear indication of the quality of this model: statistically, its validity and reliability is satisfactory (Fornell and Larcker, 2016).

3.3. Structural Model Quality

In Table 2, experience as a moderator (E2) has moderate power (R^2 = 0.326) on adoption intention (ADIN; R^2 = 0.157), while other latent variables have weak: R^2 = 0.023, R^2 = -0.189, R^2 = 1.081, R^2 = 1.104 for ATB, EE, PBC, and SN, respectively. Also shown in Table 2 are the resulting values of cross-validated redundancy, where all Q^2 were between 0.03 and 0.30: ATB = 0.219, ADIN = 0.248, E2 = 0.191, PBC = 0.082, and SN = 1.271, representing the accuracy of these latent variables in predicting adoption intention.

Table-2. Reliability and validity of latent variables and internal loading.

LV	Fornell–Larcker Criterion												
	ADIN	**ATB**	**E2**	**EE**	**PBC**	**SN**	**IL**	**α**	**CR**	**AVE**	**VIF**	**R^2**	**Q^2**
ADIN	**0.747**						0.747 0.776 0.740	0.742	0.828	0.543		0.157	0.248
ATB	0.140	**0.702**					0.778 0.828 0.817 0.717	0.733	0.813	0.535	1.084	0.023	0.219
E2	0.283	0.042	**0.730**				0.717 0.749 0.726 0.864 0.775	0.751	0.778	0.536	1.110	0.326	0.191
EE	-0.142	-0.232	0.132	**0.701**			0.751 0.762 0.718	0.771	0.685	0.489	1.082	-0.189	-0.301
PBC	0.189	0.075	0.151	0.015	**0.717**		0.800 0.874 0.774	0.876	0.547	0.589	0.051	1.081	0.082
SN	0.149	-0.048	0.275	0.230	0.241	**0.76**	0.726 0.749 0.784 0.702 0.771	0.804	0.526	1.040	1.104	1.014	1.271

Note: LV, latent variables; Fornell–Larcker Criterion for discriminant validity; IL, indicators' loading; α = Cronbach's α; CR, composite reliability; AVE, average variance extracted; VIF, variance inflation factor.

Finally, none of the VIF values from Table 2 were ≥ 5, which represents no collinearity and thus no bias in the path coefficients. This study's R^2 indicates moderate power for adoption intention in the developing subregions of the African continent, as well as other developing African nations excluded from the survey. Figure 2 is a map of Africa showing the various structural dimensions for regional development related to ICT in the educational policy framework (2006–2009). Specifically, the external funding indicated in Figure 2 for Telecoms Harmonization (1998–2004) to central Africa was part of the restructuring of the telecommunications industry in Africa; the development of an M-learning policy was part of this harmonization, to reform education through ICT, e-learning, and M-learning across the subcontinent by the government.

Analyzing the hypotheses, all five demonstrated positive predictive levels; as can be seen in Table 3, the major constructs of (TPB)—attitude toward behavior (ATB), subjective norms (SN), perceived behavioral control (PBC), enabling environment (EE), and experience (E2)—are positively significant in relation to adoption intention (ADIN) for M-learning in higher education. H4: for EE's association with ADIN is significant (β = 0.173, M = -0.085, t =1.423, SD = 0.013, p = 0.000**, f^2 = 0.035) with R^2 = -0.189. This predictive significance is satisfactory, as with the other hypotheses that are all positively associated with adoption intention. The path coefficient of H5 for E2 moderating ADIN is significant (β = 0.269, M = 0.315, t = 3.065, SD = 0.106, p = 0.002**) and with R^2 = 0.326, supported the hypothesis. All the other core constructs of TPB are also significantly related to adoption intention: H1 for ATB's influence (β = 0.145, M = 0.060, SD = 0.116, t = 1.202, p = 0.021*); H2 for SN's relationship (β = 0.083, M = 0.137, SD = 0.094, t = 1.865, p = 0.002**); H3 for PBC's relationship (β = 0.120, M = 0.078, SD = 0.094, t = 2.866, p = 0.001**).

Table-3. Significance testing results for the structural model path coefficients.

Hypothesis		M	SD	t	f^2	Effects		Inference
						β	p	
H1	ATB -> ADIN	0.060	0.116	1.202*	0.025	0.145	0.021	supported
H2	SN -> ADIN	0.137	0.094	1.865**	0.108	0.083	0.002	supported
H3	PBC -> ADIN	0.078	0.094	2.866**	0.016	0.120	0.001	supported
H4	EE -> ADIN	-0.085	0.013	1.423**	0.035	0.173	0.000	supported
H5	E2 -> ADIN	0.315	0.106	3.065**	0.082	0.269	0.002	supported

Note: H, hypothesis; M, mean; SD, standard deviation; t, t-value; f^2=effect size; P, p-value. * t-value at $p < 0.05$; ** t-value at $p < 0.01$; *** t-value at $p < 0.001$.

Such predictive significance shows that a government policy of transformation and harmonization in higher education to promote the adoption of M-learning is feasible. High school students in the 21st century are technically inclined to and experienced with digital learning, attaching more importance to their mobile phones than their books. Therefore, a technological innovation policy can positively influence learners to use their mobile phones as study tools, enhancing active learning. Preventing the use of mobile devices in schools for fear of possible misapplication is misplaced in the digital age; it is grounded theory for educational policy, offering the potential to enhance knowledge. Due to the ongoing grievance against the ban on mobile phones in senior high schools (SHS), in some parts of the African continent, including Ghana, the author recommends a policy framework for all education entities across the subregions of the African continent to ensure maximum adoption of M-learning. This will help reduce the doubt and indecision surrounding M-learning, which policymakers have displayed for years when talking to the media, parents, and students.

As detailed earlier, of the two additional constructs of enabling environment (EE) and experience as moderator (E2), the former has weaker significance in adoption intention (CR = 0.685, R^2 = -0.189) than the latter (CR 0.778, R^2 = 0.326). Learners' experience with mobile technology thus supports an M-learning policy in schools, in contrast to a lack of educational policy toward creating an enabling environment, as highlighted in Figure 3 (Yen *et al.*, 2017). The TPB analysis is consistent with both the current study and a previous study of behavior in terms of young residents' intention to use urban green spaces in Phnom Penh, because the attitude, subjective norms, and perceived behavioral control all satisfy the construct. In a similar vein to this study, Baek *et al.* (2017) examined the attitudes of teachers in Korea and found that of three dimensions, attitudes were highest for the Forms of Mobile Learning Application and Tools' Sufficient Adequacy of Communication (FMA&TSAC). By implication, more teachers and professionals accept M-learning for teacher–learner exchanges. Another study Rahimi and Miri (2014) revealed the advantage of a mobile dictionary for high school students to easily and conveniently learn new words within the school environment, resulting in a positive learning performance. To conclude, Figure 3 shows that the loadings for both observed and unobserved variables exceed the threshold of 0.7 (Claes and David, 2012)

confirming the theory that M-learning is a vital factor in transforming school education and enhancing learners' experience.

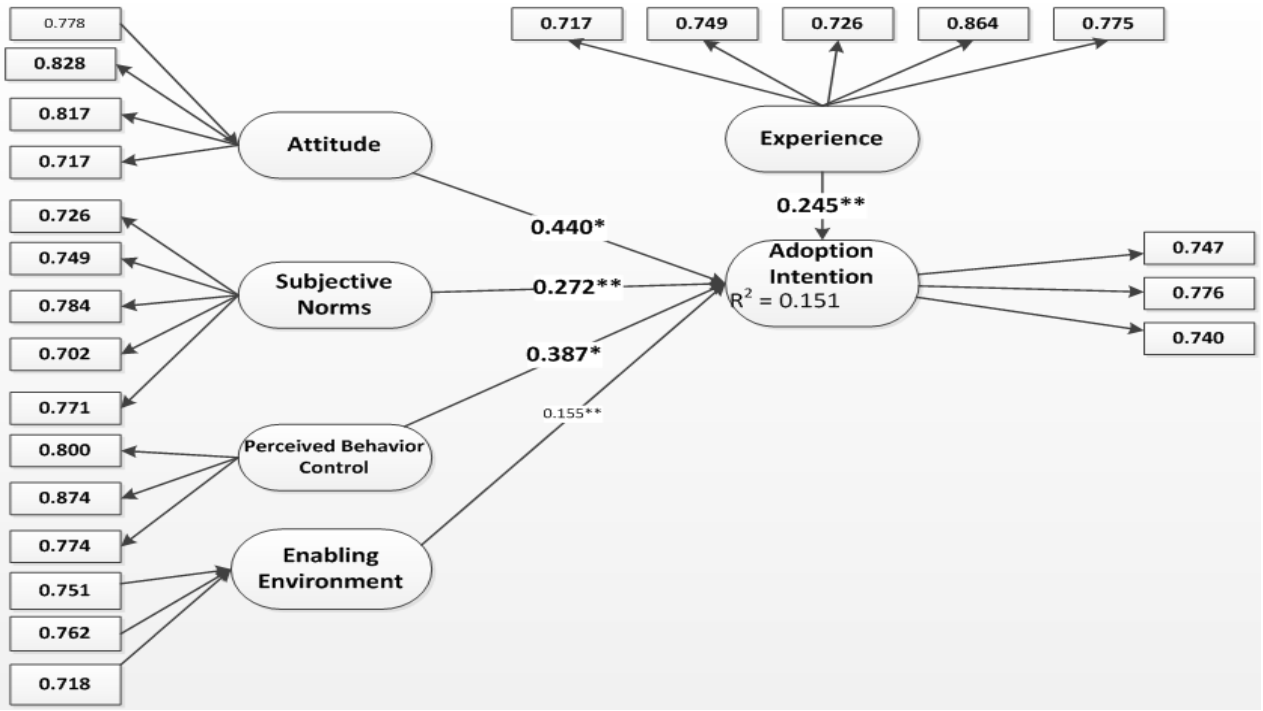

Figure-3. Conceptual Model Indicator Loadings.

4. DISCUSSION

In this study, the psychological impact of TPB in encouraging adoption intention for an M-learning policy in higher education is revealed because all the measured constructs significantly support the hypotheses. These results indicate the accepting attitudes and subjective norms exhibited by the school learners in their use of M-learning. Moreover, the study revealed that effective investigations would enhance the integration of government policies on M-learning in developing countries. The TPB core constructs provide predictive significance to the research, along with the additional variables of learners' experience with mobile devices in an enabling environment—in this case, the school.

In effect, the adoption of M-learning depends on students' attitudes, subjective norms in teachers' experiences, and expertise in the technology. Studies on M-learning have found that any new technology must be compatible with users' prior experience and habits if it is to be accepted; this fact, in conjunction with trends in modern learning concepts, will exert a strong influence on adoption intention (Marquez *et al.*, 2015). The author discovered that learners surreptitiously use mobile phones in school, through online chat with their peers and downloading learning materials for their personal study. Thus, both the constructs of enabling environment and experience satisfactorily supported the hypotheses of this study. However, all current M-learning activities in schools lack a policy framework, which the emails received from teachers and professionals with ICT expertise advocated. A government policy would not only enable the smooth implementation of M-learning but also facilitate progress across the subregions on the African continent in the future, which is threatened by learners' clandestine use of mobile devices (Asare and Nti, 2014).

A survey by Africa Tracking Internet Progress found that attitudes toward M-learning in developing countries is encouraging: about 1.5 million high school students own mobile phones, illustrating that 72% are downloading learning materials, while 46% had no internet access but wished to use it; the research therefore suggested that a government policy on M-learning was essential before young people developed bad habits with the technology

(GSS & GDHS, 2008); (Al-Emran *et al*., 2016). The study has been corroborated by a professional educationalist from a pilot program incorporating mobile devices into e-learning, reducing the pressure of demand for PCs and laptops, and demonstrating how M-learning offers a cheaper alternative. Therefore, this study proposes regulatory legislation to use an M-learning policy as a complement to e-learning and ICT in developing African countries.

5. CONCLUSION

By using the TPB theory, this study has discovered behaviors underpinning an intention to adopt an M-learning policy in higher education, professionals' perspectives in developing countries, and that experience and an enabling environment are statistically significant to adoption intention. While these results constitute a comprehensive assessment of learners' intentions, the lack of a government policy is a hindrance to the development, application, and exploration of M-learning. However, targeting high school students in developing countries only might not be fully representative, especially due to the exclusion of elites and parents. Thus, further research could investigate the perspectives of policymakers and parents, and others in different subregions of the African continent; this would add more variables on how the adoption of an M-learning policy can be assimilated into higher schools of learning to achieve academic excellence.

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APPENDIX

The Adoption of an M-Learning Policy in Higher Education: The Professionals' Perspective in Developing Countries

A standardized attitudinal scale survey instrument adapted for participants to respond using a 5-point Likert scale: from *(1) STRONGLY DISAGREED (SD), (2) DISAGREED (D), (3) UNDECIDED (UN), (4) AGREED (A),* to *(5) STRONGLY AGREED (SA).*

Dear Respondent,

This study intends to investigate the adoption of a mobile learning (M-learning) policy in higher education, to encourage learner's efficient and effective use of technology for better learning outcomes.

This survey also aims to advocate a government policy on mobile technology, which can engage students in "learning by doing" activities and demonstrate that M-learning in schools is not a misplaced priority.

The anonymity and confidentiality of all respondents is guaranteed.

The researcher is a masters' student in the School of Public Affairs at the University of Science and Technology of China (USTC). Please answer all the questions honestly according to your actual observations and attitudes. All the information will be used for purely academic, and not for any commercial, purpose. Thank you for taking the time to complete this questionnaire, and please accept my heartfelt appreciation!

Demographic Profile

1. Gender

Female	
Male	

2. Age range

< 15 Yrs	
16–18 Yrs	
19–22 Yrs	
23–25 Yrs	
26–30 Yrs	

3. Level of education

JHS	
SHS/Middle	
Bachelors	

4. Are you a mobile phone user?

Yes	
No	

5. Country or region:

……

Descriptions of the Main Variables in this Research Study

Behavior Intention (BI): Learners' instinctive motivation to consciously plan or decide to use mobile learning (M-learning) inside or outside school, or for a specific learning outcome.

6. Mobile learning is a good initiative for future regulations in education.

7. I intend to use mobile learning in the dormitory.

8. I prefer to use mobile learning than the computer.

9. I sometimes use mobile learning for reading.

10. I want to use mobile learning for further research.

Adoption Intention (ADIN): Learners' strong inclination toward or interest in accepting mobile learning technology in education.

ADIN	**11.** I intend to use mobile learning in school in my search for knowledge.
	12. I will continue to use mobile learning in the school, NOT the classroom.
	13. The use of mobile learning is now a portable and useful tool in education.
	14. I will recommend mobile learning to others in high schools.

Perceived Self-Learning Usefulness (PSLU): Learners believe that using mobile learning (M-learning) will personally enhance their academic performance without an instructor (tutor): "learning by doing."

PSLU	**15.** I think using mobile learning would make it easier for me to search for learning materials.
	16. Using mobile learning would make it easier for me to discuss topics with teachers online.
	17. Using mobile learning enables me to quickly take notes via social media (WeChat, WhatsApp).
	18. Using mobile learning will enable me to read anywhere I am more effectively.
	19. I find mobile learning very useful in the digital age.

Perceived Ease of Use (PEOU): Learners believe using mobile learning (M-learning) technology is easy, effortless, or accessible.

PEOU	**20.** I think learning to use mobile learning is easy for high school students.
	21. I think finding what I want via mobile learning is practical and undemanding.
	22. I think the skill in mobile learning is having quick access to a phone.
	23. I think using mobile learning motivates students.

Attitude toward Behavior (ATB): An individual's evaluative feelings about and interest in an action, as well as the outcome from performing the action. Innovation is the outcome of habit linked with interest in the work.

ATT	**24.** I think students' addiction to phones facilitates mobile learning as a useful tool for academics in schools.
	25. Students' access to mobile phones facilitates M-learning.
	26. Students' typical usage of phones means mobile learning is more of a hobby.
	27. Mobile learning makes reading enjoyable and exciting.
	28. I think the use of mobile learning has become a habit.

Subjective Norms (SN): Learners' perception of social norms or pressure from teachers and authorities to undertake mobile learning (M-learning), and of regulations for the use of technology in schools.

SN	**29.** Most teachers/learners' now approve of mobile learning in schools.
	30. School friends think mobile learning is a good idea for online chat.
	31. I think regulations will help implementation.
	32. Using mobile learning alongside formal education is fun.
	33. Society thinks mobile learning should be avoided to deter students' misuse of phones.

Perceived Behavioral Control (PBC): Whether experts perceive performing an action (the means) will be easy or difficult to implement with a mobile learning (M-learning) policy.

PBC	**34.** Using mobile learning is a matter of choice and interest.
	35. Mobile learning is a good idea in schools.
	36. I prefer using mobile to computer-based learning in schools.
	37. Every student now owns a mobile phone for mobile learning in schools.

Enabling Environment (EE): The physical or social setting (the environment) that facilitates learners' use of mobile learning to easily and calmly acquire knowledge.

EE	**38.** I use mobile learning in parts of the school.
	39. I plan to use mobile learning in the school dormitories.
	40. I will use mobile learning everywhere or somewhere in the school.
	41. I will use mobile learning for group discussion on social media anywhere in the school.