

THE INFLUENCE OF ICT INFRASTRUCTURE ON READINESS TO ADOPT
E-LEARNING IN SECONDARY SCHOOLS IN KITUI DISTRICT, KENYA

BY

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ABSTRACT

This article advocates for speedy provision of ICT infrastructure in all secondary schools to make it possible for the teachers and learners to adopt e-learning to accelerate development and economic growth of our Nation. The article explores the relationship between ICT infrastructure and readiness to adopt e-learning in secondary schools. It is based on literature review and field research by employing cross-sectional survey research design to determine the extent to which Information Communication Technology (ICT) infrastructure influences readiness to adopt e-learning in secondary schools in Kitui district. A single questionnaire coupled with observation schedule were used to collect data from 15 provincial and 36 District schools selected through stratified random sampling. Null hypotheses were tested by using two way ANOVA at 0.05 and regression analysis. The results established that institutional factors such as infrastructure (connectivity, sources of energy and e-equipment) have a significant influence on readiness to adopt e-learning. However, most schools in Kitui district did not have adequate infrastructure to support the adoption of e-learning. It was recommended that the government should seek to address the issue of e-learning infrastructure in secondary schools in Kitui district and indeed all other districts before embarking on full scale implementation of e-learning in schools.

Key Words= Connectivity, Power/Energy, Equipment

INTRODUCTION

Information and Communication Technology (ICT) plays a key role in promoting economic development of a country. Many of the economic gains in the developed world economies over the past two decades could be to a great extent attributed to the impact of ICT, (UNESCO 2004)

There is no doubt that the advances in information and communication technology have enabled people all over the world to share ideas faster and more effectively at far distances. Many countries both in developed and developing economies have adopted the modern electronic communication technology for different operations in their economies. However, the extent to which a country is able to participate and benefit from the electronic communication technology depends on the country's digital divide as well as availability of e-infrastructure and technical knowhow in the country, (UNESCO, 2004).

ICT infrastructure is a basic requirement for adoption of e-learning in learning institutions and indeed any organization. The concept of ICT infrastructure denotes all the facilities necessary for effective e-learning in schools. Such facilities include equipment, connectivity and sources of energy. ICT infrastructure is a basic requirement for adoption of e-learning. The concept of ICT infrastructure denotes all the facilities necessary for effective e-learning in schools. Such facilities include equipment, connectivity and sources of energy. Furthermore, the question of availability of e-infrastructure needs to be dealt with at institutional level in order to give a true picture of the specific operational environment. Such infrastructure includes connectivity to various networks (internet, intranet, and mobile-telephone); sources and reliability of energy (UPS, electricity, standby generators); equipment (computers, radios, videos, television, LCD projectors and software, e-learning laboratories furniture and stores and information storage facilities such as flash disks, CD-ROMs, DVDs).

The Ministry's Policy Framework indicates that there are a number of challenges concerning access to and use of ICT in Kenya. This includes high levels of poverty, limited rural electrification and frequent energy disruptions as well as lack of computers and adequate connectivity, (National ICT policy, 2006).

Successful e-pedagogy depends on effective e-facilitation, which can be made difficult or possible by various factors depending on how prepared the implementers are. Lumumba (2007), in his study on the challenges facing e-learning at public secondary schools, based on the NEPAD pilot project schools in Kenya established that the e-learning project was faced by many challenges. He singled out lack of adequate e-learning facilities (infrastructure), as key obstacles to the success of the e-learning project. He attributed such challenges to lack of preparedness among the institutions and implementers before the implementation process began. The study recommended that, for successful implementation of e-learning in educational institutions to be enhanced, the factors determining the readiness to adopt e-learning be established and dealt with adequately before the implementation process commences. However, the extent to which availability of ICT infrastructure influences readiness to adopt e-learning in Secondary Schools was not addressed. .

It is worth noting that studies that have been carried out on the area of e-learning (ICT) adoption and diffusion were based on the developed countries and therefore the findings can be generalized especially in developing country like Kenya with a lot of caution. Literature on e-learning in secondary schools is scanty but they all point out that there is a big gap between policy and practice when it comes to readiness of secondary schools to adopt e-learning. The few studies that have been carried out on use of ICT in curriculum implementation at Secondary schools in Kenya (Lumumba, 2007; Ayere at-el, 2010 and Keiyoro, 2010) were based on NEPAD and CSTS e-schools which were set up as Centres of excellence in e-learning integration, so that other schools could copy their model. For this reason the schools were provided with computers, e-materials, internet appliances and trained personnel. Such studies do not

reflect the real situation of readiness to adopt e-learning in normal Kenyan Secondary Schools This article examines the concept of e-learning, followed by a brief discussion on the influence of ICT infrastructure on readiness to adopt e-learning. The rest of the article describes the methodology used, data analysis, interpretation and discussion of findings and finally outlines the recommendations to improve the speed to which the government and the secondary schools are moving towards the installation of ICT infrastructure as the basic requirement for sustainable adoption of e-learning in secondary schools.

THE CONCEPT OF E-READINESS

McConnell Intl, (2001) describes e-readiness as the measure of the extent to which nations are capable to participate in the networked world. He clarifies that e-readiness measures the capacity of a nation to participate in the digital economy by judging the relative advancement of the key important applications. E-readiness originated with the attempt to provide a unified framework to evaluate the breadth and depth of the digital divide between the less developed and the developed countries (Arce and Hopman, 2002). Today there is no doubt that there is a wide gap between the developed and the developing world in terms of e-readiness. It is therefore agreeable that e-readiness is a critical area that must be assessed and prudently addressed before adoption of e-learning in Kenyan learning institutions and indeed all other developing countries.

Gakuu (2006) observes that information is now viewed as a basic raw material that is being consumed at an enormous scale in the socio-economic processes and thus having competitive importance. Sadly, neither competitive value accrues evenly across countries nor technological diffusion limits the difference in national, political, economic, social and cultural structures. Thus Carlsson, (2004) claims that, it is very likely that digitization of information will only benefit a few countries which have the capacity to harness the required resources. It is also true to say that even within a country only some few well endowed regions will be able to benefit from the digitization of information due to different levels of development.

Various international agencies have focused their attention on the phenomenon of the digital divide; The UN, UNESCO, OECD, UNDP, the World Bank and many others. In particular, UNESCO was the first international body who focused on the issue of digital divide which it considered as one of the most pressing ethical and social challenges of our time. In a recent document named "Towards the knowledge Society", (UNESCO World Report (2005), it is claimed that bridging the digital divide is a priority of UNESCO mission.

Focus is placed on the need to develop a culture of knowledge enabling not only "formal" but also "effective" access for all to information and communication technologies (ICT). It is pointed out in the UNESCO (2005) that new technologies cannot be implanted from the top in deprived and disadvantaged contexts. In order to be effective; they need to come as specific local needs by means of a "bottom-up" process. It is therefore paramount to start from local practices and involve all the actors concerned (at institutional and non institutional levels) in the specific contexts where such projects and policies are implemented. It is for this reason that the current study focused on specific institutional and human factors that influence readiness to adopt e-learning in secondary schools.

THE INFLUENCE OF ICT INFRASTRUCTURE ON READINESS TO ADOPT E-LEARNING

E-learning is new in many developing countries and is somewhat being practiced on a trial and error method. It is actually at infancy stage. A number of African countries have just completed the pilot stage with the NEPAD e-schools e-learning project. The experience of these schools in the pilot study indicate that successful implementation of e-learning in secondary schools needs careful planning as there are many challenges that need to be addressed.

The Kenya Internet Usage and Marketing Report (2006) indicate that only a few people in Kenya have a computer at home. Radio and television access is much better while mobile phone are common place and the number of internet users is increasing rapidly due to the number of internet cafes, shops and access centres that are available, particularly in urban areas. However, it is feared that, due to wide use of English in Kenya usage of internet may be congested since most sites on the internet are in English (Kenya Internet Usage and Marketing Report, 2006). Table 2.1 below provides a statistical overview of the ICT infrastructure that is available to the general population in Kenya.

Table 1: ICT Infrastructure in Kenya

Type of Infrastructure	No. Of subscribers
<i>Telephone lines(2005)</i>	281,800 (2005)
Mobile telephones (2006)	4,612,000 (2006)
Internet users (3.1% of the population)	200,000 and 1,054,900 (2000 & 2006)
Internet hosts	13,274 (2006)
Television Broadcast stations	8 (2002)
Radio stations	24 AM; 18FM (2001)

Source: The world Fact Book, (2007)

As shown in Table 1, only a small percentage of the Kenyan population has access to ICT infrastructure (only 3.1% internet users). However, given the high rate at which the use of ICT is spreading especially the mobile phones and the internet, there is hope that in few years time many Kenyans will have access to ICT.

Kenya data profile (2006) indicates that most secondary schools have some computer equipment. However, this could consist of one computer in the office of the Head teacher. The profile also points out that very few secondary schools have sufficient ICT tools for teachers and students. Further, it was observed that even in schools that have computers, the student-computer ratio is 150:1 (Kenya data profile, 2006). Notably, given that the conditions above are described as they were in 2006, it is likely that with the effort made by the government toward preparation for introduction of e-learning in schools, things have improved and hence the need for a study to establish the current situation at the grassroots.

The major problem pointed out by the Data and Statistics (2006) was that Kenya lacked adequate connectivity and network infrastructure. It was pointed out that, although a small number of schools had direct access to high speed connectivity through an internet service provider, generally there was limited penetration of the national physical telecommunication infrastructure into rural and low-income areas. This fact raised a greater need for investigating the role played by ICT infrastructure in determining readiness to adopt e-learning in secondary schools against the ministry's plan to leverage the e-government initiative of networking public institutions countrywide to facilitate the educational sector.

METHODOLOGY

The study adopted cross-sectional descriptive survey design. The design was chosen for this study due to its ability to ensure minimization of bias and maximization of reliability of evidence collected. Furthermore descriptive survey design raises concern for the economical completion of the research study. The method is rigid and focuses on the objectives of the study. The study used ex-post-facto design, which is a systematic empirical inquiry in which the researcher does not have direct control of independent variables because their manifestation have already occurred or they are inherently not manipulable, (Emory,1985).

The study further adopted a combination of both qualitative and quantitative techniques which according to Emory (1985) and Kothari (2004) supplement each other in that qualitative technique provides the in-depth explanations while quantitative technique provides the hard data needed to meet the requirements of objectives and to test hypotheses. The philosophical foundation of this study is positivism which stresses that the social world exists externally, and that its properties should be measured through objective methods, rather than being inferred subjectively through such approaches as intuition, sensation and reflection, (Easterby-Smith, Thorpe and Lowe, 2002)

The population for this study included 51 out of 80 Public Secondary Schools in Kitui District. The sample was selected through stratified random sampling. Data were collected by means of a questionnaire and observation schedules. To ensure reliability of the research instrument self-administration approach was applied in data collection and Cronbach's co-efficient Alpha was determined in order to measure internal consistency of the research instruments.

Data analysis was done following the four phases normally used in many research projects, namely, data clean up, data reduction, data differentiation and explanation. Factor analysis was done to identify the most important infrastructure factors in influencing readiness to adopt e-learning by computing factor loadings for each factor. These are the factors that were used in further analysis of the variables. In this study, parametric tests were used since they are more powerful due to their ability to reduce chances of committing type II error, less likely to not reject a null hypothesis which should be rejected. The main approaches used were the Analysis of Variance ANOVA, Pearson's coefficient of correlation and Regression analysis.

Operationalization of the dependent and independent variables

Operational definition of the dependent and independent variables is provided here. In this study the dependent variable for is readiness to adopt e-learning, while the independent variable is ICT infrastructure whose key indicators include connectivity, sources of power and equipment.

Table 2: Summary of Variables and Indicators

VARIABLE	INDICATORS	MEASUREMENT SCALE
Infrastructure	Connectivity <ul style="list-style-type: none">• Internet connectivity• mobile network coverage• Intranet connectivity	

	<p>Sources of power/energy</p> <ul style="list-style-type: none"> • Electricity • Standing generators • Uninterruptible energy supply (UPS) 	Ratio scale
	<p>Equipment</p> <ul style="list-style-type: none"> • Computers (hard software) • Radios • Televisions • Mobile phones • LCD projectors • Software • Computer laboratories • Furniture • Equipment stores • Flash disks • CD-ROMs • Diskettes • CDS 	
Readiness to adopt e-learning	<ul style="list-style-type: none"> • Reliable sources of energy. • Variety of network connections • Sufficient internet connectivity • Sufficient electronic learning equipment • Relevant skills in handling e-learning • Access to e-learning facilities in school • operationalize the e-learning machines • Teachers' and students' Interest in the use of e-learning. • Readiness to devote extra time for- e-learning • Provision of the time e-learning in the time table 	Interval scale

FINDINGS AND DISCUSSION

The study set out to establish the significance of infrastructure in influencing readiness to adopt e-learning in curriculum implementation. ICT infrastructure was studied under three indicators, namely; connectivity, source of power/energy and equipment, from which three hypotheses were formulated to guide the study. Readiness was measured using two key indicators, namely; availability of sufficient electronic-learning equipment and availability of relevant skills in handling e-learning.

Principals' Evaluation of the Schools' Readiness to adopt e-learning based on e- Infrastructure

The principals were requested to indicate the extent to which their schools were ready to adopt e-learning in relation to availability of various facilities essential for e-learning which were listed in the questionnaire. They were required to indicate in a 5 point Likert scale within the range described below.

- Very great extent = 5
- Great extent = 4
- Minimal extent = 3
- Very minimal extent = 2
- No extent at all = 1

The results are summarized in Table 3.

Table 3: Principals opinion on the extent to which their schools' are ready with e-infrastructure

<i>Facilities</i>	<i>Very great extent</i>	<i>Great extent</i>	<i>No extent at all</i>	<i>Minimal extent</i>	<i>Very minimal extent</i>
CONNECTIVITY					
Internet connectivity	15.7	33.3	27.5	7.8	15.7
Mobile network coverage	41.2	15.7	21.6	15.7	5.9
Intranet connectivity	25.5	23.5	41.2	2.0	7.8
EQUIPMENT					
Computers	21.6	35.3	19.6	13.7	9.8
Mobile telephones	39.2	11.8	15.7	29.4	3.9
LCD Projectors	7.8	27.5	51.0	3.9	9.8
SOURCES OF POWER/ENERGY					
Electricity supply	60.8	19.6	9.8	7.8	2.0
Uninterruptible Power Supply (UPS)	23.5	25.5	39.2	7.8	3.9
Standby generators	27.5	23.5	31.4	7.8	9.8

The findings shown in Table 3 indicate that over half of the schools enjoyed reliable mobile network coverage as reported by 56.9% of the principals, though some 21.6% complained of total lack of network coverage in their schools while another 21.6% suffered unreliable network coverage. This shows that, though mobile network coverage was spread over many areas in the district some areas were still either not covered or the network was not reliable. According to the findings, the schools were found to be at varied levels of readiness in relation to internet connectivity. Schools that had very great access to internet constituted 15.7% while those with great access were 33.3%. Twenty seven percent (27%) of the schools had no access to internet at all, while the extent of access to internet of the remaining 7.8% and 15.7% of the schools had minimal to very minimal extent of access to internet probably, because they could only access the internet from the cyber cafes in Kitui town. With regard to intranet connectivity, only 49% of the schools were reportedly ready with this facility, while 10% had minimal to very minimal intranet connectivity. The remaining 41% had no intranet connectivity at all.

Most Principals felt that their schools were ready with electricity supply. For example 60.8% were ready to a very great extent while 19.6% were ready to great extent. Those whose schools were ready to minimal and very minimal extent constituted a combined percentage of 9.8% while those not ready at all were 9.8%. Electricity seemed to have spread out to many schools thanks to government policy of Rural Electrification. The study reveals that almost half of the schools had either Uninterruptible Power Supply (UPS) or standby generators. Some 49% had UPS and 51% had standby generators while 51% and 49% respectively do not have. This indicates that such sources of power/energy were not as widespread as electricity. The availability of electricity could have been made through the implementation of rural electrification programme.

LCD Projectors were rare equipment in many of the schools. For example 51% of the schools were not ready with LCD projectors, 3.9% and 9.8% were ready to a minimal and very minimal extent respectively. However, 27.5% were ready to a great extent and only 7.8% of the schools was ready to very great extent. This could be due to the high cost and skill requirement for the equipment. With regard to availability of computers in schools, 21.6% were ready to adopt e-learning to a very great extent while 35.3% ready to a great extent as they had enough computers. However, 13.7% were ready to a minimal extent while 9.8% were ready to a very minimal extent and only 19.6% were not ready at all. This is an

indication that with some government subsidy on computers, the schools could easily attain the required level of readiness to adopt e-learning. Furthermore, the findings indicate that a combined percentage of 51% of the principals felt that their schools had enough mobile phones which could facilitate e-learning, while 33.3% felt that their schools did not have adequate mobile phones to support adoption of e-learning while 15.7% were not ready at all. This implies that a lot of investment needed to be committed to equipping the schools with e-facilities so as to improve on the school's readiness to adopt e-learning as they were found to be very poorly equipped. The findings of the study were scientifically validated through testing of the following three hypotheses.

Hypothesis H₁ Information Communication Technology (ICT) connectivity has no significant influence on readiness to adopt e-learning in Secondary Schools

ICT connectivity was measured in terms of internet connectivity, intranet connectivity and mobile telephone network connectivity/coverage. A summary of the findings is provided in Table 4.

Table 4: The influence of Information Communication Technology Connectivity on Readiness to adopt e-learning.

		Schools' readiness to adopt e-learning subject to availability of sufficient electronic equipment	Schools' readiness to adopt e-learning subject to availability of relevant skills in handling e-learning
Internet connectivity	Pearson Correlation	.330(*)	.313(*)
	Sig. (2-tailed)	.018	.025
	N	51	51
Intranet connectivity	Pearson Correlation	.233	.254
	Sig. (2-tailed)	.100	.072
	N	51	51
Mobile network coverage	Pearson Correlation	.245	.256
	Sig. (2-tailed)	.083	.070
	N	51	51

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

The first finding on hypothesis H₁ indicated that ICT connectivity has positive influence on readiness to adopt e-learning. Internet connectivity had a significantly positive influence on readiness to adopt e-learning while intranet and mobile telephone network connectivity/coverage had insignificantly positive influence on readiness to adopt e-learning.

Table 5 Regression Prediction Model for Connectivity and Readiness to Adopt e-Learning subject to Availability of Relevant Skills in Handling e-Learning

Model summary	R	R ²	Adjusted R ²	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df 1	df2	Sig. F Change
	.344(a)	.118	.062	1.20961	.118	2.103	3	47	.113
Model ANOVA		Sum of Squares		df	Mean Square	F	Sig.		
	Regression	9.231		3	3.077	2.103	.113(a)		
	Residual	68.769		47	1.463				
	Total	78.000		50					
Model Coefficients		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		
		B	Std. Error	Beta			Lower Bound	Upper Bound	
	(Constant)	2.937	.463		6.348	.000	2.006	3.868	
	internet connectivity	.198	.170	.202	1.163	.251	-.144	.540	
	Mobile network coverage	.109	.152	.115	.718	.477	-.197	.416	
	intranet connectivity	.111	.181	.101	.612	.543	-.253	.474	

a Dependent Variable: Readiness to adopt e-learning subject to availability of relevant skills in handling e-learning

Table 6: Regression model for Connectivity and Readiness to Adopt e-learning subject to availability of Adequate Electronic Learning Equipment

Model Summary	R	R ²	Adjusted R ²	Std. Error of the Estimate		
1	.347(a)	.120	.064	1.60110		
Model ANOVA	Sum of Squares		df	Mean Square	F	Sig.
	Regression	16.495	3	5.498	2.145	.107(a)

	Residual	120.485	47	2.564		
	Total	136.980	50			
Model Coefficients		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
	(Constant)	2.301	.612		3.757	.000
	internet connectivity	.322	.225	.249	1.431	.159
	mobile network coverage	.122	.202	.097	.604	.549
	intranet connectivity	.091	.239	.062	.380	.705

a Dependent Variable: School's readiness to adopt e-learning subject to availability of sufficient electronic learning equipment

The findings of the regression prediction model for ICT connectivity and readiness to adopt e-learning based on the two indicators of readiness (availability of relevant skill in handling e-learning and availability of sufficient electronic learning equipment) indicated that ICT connectivity could be used to predict a schools' readiness to adopt e-learning, with the connectivity accounting for up to 12% of the change in a school's level of readiness to adopt e-learning.

It was further discovered that internet connectivity is the most important type of connectivity since it accounted for almost half (1/2) of the ICT connectivity as it is evidenced by the beta values of the connectivity indicators. The beta values for the three connectivity indicators (internet connectivity, intranet connectivity and mobile telephone connectivity) were 0.202, 0.101, and 0.115 respectively, when readiness is measured in terms of the availability of relevant skills in handling e-learning and 0.249, 0.062 and 0.097 respectively when readiness is measured in terms of the availability of sufficient electronic learning equipment. This implies that without sufficient and reliable internet connectivity in the schools successful adoption of e-learning in the implementation of secondary school curriculum will be impossible. In fact unless the government plans and ensures that schools especially in the rural areas are connected to internet the benefits associated with e-learning may end up being enjoyed by only a few urban schools which are capable of acquiring internet connectivity on their own. Based on these findings therefore, the null hypothesis which stated that the ICT connectivity has no significant influence on readiness to adopt e-learning in secondary schools was rejected and it was concluded that readiness to adopt e-learning in secondary school is significantly influenced by the level of ICT connectivity in the schools.

Hypothesis H0₂, Sources of energy do not significantly influence Secondary Schools' readiness to adopt e-learning.

The indicators for sources of energy/power included electricity supply, uninterruptible power Supply (UPS) and stay-by generators. The findings indicated that the source energy/power has a Positive influence on readiness to adopt e-learning which was tested as shown on Table 5.

Table 7: The Correlation between Sources of Energy/Power and Readiness to adopt e-learning

Schools' readiness to adopt e-learning based on;		Electricity supply	Uninterruptible power supply (UPS)	Standby generators
Availability of relevant skills in handling e-learning	Pearson Correlation	.316(*)	.256	.255
	Sig. (2-tailed)	.024	.070	.071
	N	51	51	51
Availability of sufficient electronic learning equipment	Pearson Correlation	.378(**)	.374(**)	.364(**)
	Sig. (2-tailed)	.006	.007	.009
	N	51	51	51

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

It is evident in table 5 that electricity supply, uninterruptible power supply (UPS) and standby generators (indicators of sources of energy) correlated significantly and positively with the availability of sufficient electronic learning equipment (which was an indicator of readiness to adopt e-learning) with correlation coefficient of $r = 0.378$, 0.374 and 0.364 respectively, while $P = 0.01$.

This implies that, availability of e-learning equipment will be a sufficient measure of schools' readiness to adopt e-learning only if reliable sources of energy are available. It is also common sense that electronic equipment cannot be practically useful unless there is reliable source of power/energy. For example equipping a school with computers without providing the school with reliable sources of power will be of no use since the computers cannot be utilized unless they are connected to power.

Hypothesis H0₃ (ICT) equipment does not have significant influence on Secondary Schools' readiness to adopt e-learning.

The findings on this hypothesis indicated that information and communication technology (ICT) equipment had significantly positive influence on readiness to adopt e-learning in secondary schools as shown in Table 6.

Table 8: The influence of ICT Equipment on Readiness to Adopt e-learning

Schools' readiness to adopt e-learning based on;		LCD projectors availability	Mobile telephone availability	Computers availability
Availability of sufficient	Pearson	.385(**)	.347(*)	.287(*)

electronic learning equipment	Correlation			
	Sig. (2-tailed)	.005	.013	.041
	N	51	51	51
Availability of relevant skills in handling e-learning	Pearson Correlation	.256	.303(*)	.243
	Sig. (2-tailed)	.070	.031	.086
	N	51	51	51

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

For example, availability of LCD projectors, mobile telephones and computers in schools (indicators of ICT equipment) correlated significantly positively with availability of sufficient e-learning equipment which was an indicator of readiness to adopt e-learning with a correlation coefficient of $r = 0.385$, $P < 0.01$; $r = 0.347$, $P < 0.05$ and $r = 0.387$, $P < 0.05$ respectively. Availability of relevant skills in handling e-learning, which was the other indicator of readiness to adopt e-learning was significantly and positively influenced by the availability of mobile telephones in schools. To further ascertain the importance of ICT equipment in determining readiness to adopt e-learning, a regression prediction model was developed. The findings of the model are summarized in Table 7.

Table 9: Regression Model for ICT Equipment and Readiness to Adopt E-learning subject to availability of Relevant Skills in Handling e-learning

Model	R	R ²	Adjusted R ²	Std. Error of the Estimate			
1	.367(a)	.135	.080	1.19823			
Model ANOVA		Sum of Squares	Df	Mean Square	F	Sig.	
1	Regression	10.520	3	3.507	2.442	.076(a)	
	Residual	67.480	47	1.436			
	Total	78.000	50				
Model Coefficients		Unstandardized Coefficients	Standardized Coefficients	T	Sig.	95% Confidence Interval for B	
		B	Std. Error	Beta		Lower Bound	Upper Bound
	(Constant)	2.672	.557		4.800	.000	1.552 3.792
	Mobile telephone	.239	.129	.263	1.851	.070	-.021 .498
	Computers	.023	.208	.023	.110	.913	-.395 .440
	LCD projectors	.243	.253	.194	.960	.342	-.266 .752

a Dependent Variable: Schools' readiness to adopt e-learning subject to availability of relevant skills in handling e-learning

Regression analysis produced a prediction model which could be used to estimate a schools level of readiness to adopt e-learning using ICT equipment. From the findings on the model, a schools readiness to adopt e-learning in terms of availability of relevant skills in handling e-learning could be estimated well on the basis of the extent to which the school has acquired ICT equipment. The model has an r^2 value of 0.135, meaning that 13.5% of change in a schools readiness with relevant skills in handling e-learning is accounted for by availability of ICT equipment in the school.

When ICT equipment is used to predict a schools' readiness to adopt e-learning based on the availability of sufficient e-learning equipment, the findings show that such a model is strong for estimating readiness to adopt e-learning for a given level of ICT equipment could account for approximately 31% of the change in a schools' readiness to adopt e-learning with a standard error of 1.2.

The findings therefore indicate that ICT equipment is crucial requirement for readiness to adopt e-learning in curriculum delivery. For the schools to be able to utilize this modern technology meaningfully, they must acquire the necessary ICT equipment. These would include computers, LCD projectors and mobile telephones among others. However, lack of adequate ICT equipment was reported in almost half of the schools in Kitui district, meaning that the schools were inadequately prepared to adopt e-learning hence an issue that the government needs to address by implementation of e-learning commences.

As it is evident from the study, readiness to adopt e-learning was positively and significantly influenced by ICT infrastructure. This means that successful adoption of e-learning is determined to a large extent by the extent to which schools have acquired the necessary ICT infrastructure including adequate connectivity, reliable sources of energy and ICT equipment. However, most schools in Kitui District were found to lack adequate ICT infrastructure, hence not adequately ready to adopt e-learning.

Discussion of the study findings

The study established that all the three ICT connectivity indicators had some influence on readiness to adopt e-learning in secondary schools. However, only internet connectivity had significant influence on readiness to adopt e-learning. The findings of this study also revealed that sources of power/energy such as electricity supply, uninterruptible power supply (UPS) and stand-by generators have significant influence on readiness to adopt e-learning in secondary schools. The study further showed that, ICT equipment has significantly positive influence on readiness to adopt e-learning. The study also revealed that ICT equipment was inadequate in almost half of the schools in Kitui district.

The findings of this study are in agreement with the existing literature which indicates that ICT infrastructure such as connectivity, sources of energy/power and equipment are positive influence on readiness to adopt e-learning. However, this study is different in that, while such studies did not show the magnitude of the influence of ICT equipment on readiness to adopt e-learning in secondary schools. neither the extent to which ICT equipment were available in secondary schools in Kitui district- Kenya, this current study has addressed the issue of the extent to which ICT infrastructure influences readiness to

adopt e-learning in secondary schools and the level of availability of ICT equipment in the secondary schools in Kitui district. Such studies include Lumumba (2007) Shetty (2007) Nyaki, Oyelaran and Oyeyinka (2002) and Keiyoro (2010).

Conclusions of the Study

First, it was concluded that internet connectivity is very crucial in determining readiness to adopt e-learning. It should also be noted that intranet connectivity and mobile network coverage will enhance a school's readiness to adopt e-learning especially because internet services could be accessed via mobile phones, hence mobile telephone network connectivity could suffice for internet connectivity particularly in the remotely located schools. We therefore reject the null hypothesis which stated that there ICT connectivity has no significant influence on readiness to adopt e-learning in secondary schools and conclude that readiness to adopt e-learning in secondary school is significantly influenced by the level of ICT connectivity in the schools.

Second it was concluded that availability of e-learning equipment will be a sufficient measure of schools readiness to adopt e-learning only if reliable sources of energy are available. Hence we reject the hypothesis and conclude that sources of energy/power have significant influence on readiness to adopt e-learning.

Third, it could be concluded that ICT equipment are a crucial requirement for readiness to adopt e-learning in curriculum delivery. For the schools to be able to utilize this modern technology meaningfully, they must acquire the necessary ICT equipment, including computers, LCD projectors and mobile telephones among others. Hence the null hypothesis and conclude that ICT equipment has significant influence on readiness to adopt e-learning in secondary schools. However, lack of adequate ICT equipment was reported in almost half of the schools in Kitui district, meaning that the schools were inadequately prepared to adopt e-learning hence an issue that the government needs to address before implementation of e-learning commences.

As it is evident from the study findings, infrastructure positively and significantly influenced readiness to adopt e-learning. This means that successful adoption of e-learning is determined to a large extent by the extent to which schools have acquired the necessary ICT infrastructure including adequate connectivity, reliable sources of energy and ICT equipment. However, most schools in Kitui District were found to lack adequate ICT infrastructure, hence not adequately ready to adopt e-learning.

Recommendations of the Study

Based on the discussions and findings of this study, the researchers find it in order to make a few recommendations which she considers important to guide other readers, researchers and policy makers. The recommendations have been divided into those with policy implications and those meant for other researchers for further reading.

Policy Implications

Based on the results of the study, the following recommendations are made:

The government should embark on equipping the schools with the necessary ICT infrastructure before the process of full scale implementation of e-learning commences. Specifically the government should ensure that all the schools are provided with electricity power supply, connected to internet services and equipped with adequate and up-to-date computers and LCD Projectors.

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