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Research Article

IMPACT OF INTERNET ACCESSIBILITY AND INSTRUCTOR'S COMPUTER LITERACY ON E-EDUCATION IN URBAN AND RURAL PUBLIC VOCATIONAL COLLEGES IN KENYA

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ABSTRACT

Internet has spread around the world tremendously. Yet, Africa as a whole still lagsbehind in terms of accessibility and usage.With more than 54 nations, Africa has a mixed matrix of both developed as well as very inefficient internet infrastructure. Among sizable Internet adoptability is Kenya, a country with more than 31 million users, according to 2017 data; it leadsentire Africa with Internet penetration rate of more than 66% of the population. According to public data most of the internet growth in Kenya took place since the year of 2010, which saw internet penetration grow from 14% of the population to 65% at in 2016, almost a five-fold increase.

This paper looks at the impact of Internet accessibility in Kenya with regards to e-education. In order to evaluate the situation after this fast-paced growth a survey was conducted among 464 instructors from public vocational colleges, which were selected because IT is a mandatory subject in such colleges in Kenya. The survey results show that the mode of Internet accessibility and the level of service quality, with regards to e-education, are quite different in urban colleges when compared torural colleges. Besides, the level of computer literacy of instructors differs vastly between the urban and rural area vocational colleges. When surveyed data was analyzed quantitatively, results indicate that the general readiness of e-education depends significantly on the quality of Internet accessibility and on computer literacy of instructors. It is concluded that while Kenya displays overall leadership in Africa in term of Internet accessibility, the support infrastructure needed for e-education, in terms of quality of access and quality of trained instructors, still does not measure up to the expected levels.

INTRODUCTION

While Internet has penetrated fast in many countries, it has been slow to catch up in Africa. According to statistics, while Africa's internet penetration is about 27% of population, rest of the world the penetration rate had reached almost 54% of population. However, among the countries in Africa, Kenya has achieved the highest Internet penetration of 64.9% per population in 2016 according to government data (KNBS, 2017); but according to Internet World Stats, the penetration rate in Apr 2017 stood at 74.8%. The growth of smart phones has been cited as the main reason fueling rapid Internet penetration in Kenya. According to Communication Authority Kenya (CAK), mobile money transactions had made use of smart phones popular, which directly correlates topolarity of Internet use (KNBS, 2017). It is true that Kenya has a history of initiatives, going back at least to 2004, when the country created "Kenya ICT Trust Fund" to promote initiatives in education. Then, in 2005, Ministry of Education developed "Kenya Education Sector Support Program" (KESP) with the aim of using ICT for teaching and learning. Further, National ICT Strategy for Education and Training (Farrell, 2007) was established. The most recent activities of Kenya government include the 2013 ICT Master Plan (Kenya ICT Authority, 2014). It contributed to development of infrastructure to support the Internet and general spread of ICT in the country. Perhaps, one impressive factor in Kenya's case is that the country had realized ICT as a driver of economic growth. By 2017, according to the ICT Master Plan, country expects to

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create 180,000 direct ICT jobs and make 8% contribution to its GDP through ICT sector. The masterplan also includes metrics to monitor the growth of the ICT industry, including the contribution ICT contributions to education. Among one such metric is "Proportion of ICT-qualified teachers in primary and secondary school" in Kenya.

The emphasis of ICT sector impact in education in Kenya has attracted the attention of researchers. Among the published research include, comparison of Internet utilization between rural and urban secondary schools in Kenya (Kiptalam and Rodrigues, 2010) and a case study of integration of ICT in a selected secondary school in Kenya (Kisirkoi, 2015). Other somewhat older studies on ICT relevance of Kenya's education sector includes work of Kashorda *et al*., (2007) and Wims and Lawler (2007). Also surveys by Kenya National Bureau of Statistics (KNBS) include results of ICT usage in various economic sectors in Kenya.

With regard to topic explored here, it is important to note some findings of the study by Kiptalam and Rodrigues (2010), which focused on Internet utilization. They found that differences exist between rural and urban schools as well as between private and public schools. They also found that majority of the teachers in secondary schools in Kenya did not receive ICT teacher training colleges or at universities with more than half of them had no experience of computers or ICT. But, about 50% of the teacher had undergone ICT training after being in the profession.

Concerning the research presented, a recent survey results published by Chris, (2015) also have relevance; however, that survey considered only the ICT adaptation in primary schools. This research presented, differs considerably from previous work that the authors are aware of to the best of their knowledge.

First, this research surveyed a more comprehensive section of schools, in this case vocational school, covering broad geographic area in rural Kenya as well as urban parts of the capital Nairobi. Second, this research is about e-education in Kenyan vocational colleges, where ICT is supposed to play a key role in education. Third, the research is also aimed at measuring the Instructor's Computer Literacy on E-Education, particularly at vocational college level, where ICT is highly emphasized across all disciplines, according to the aims of Ministry of Education (GOK, 2013).

In order to present the research, the paper is organized into key sections. Section 2 provides a brief summary about the general education system and e-education in Kenya. Section 3 provides the survey methodology, including an explanation of the population that was surveyed and a brief of key questions. Section 4 provides the results of the statistical analysis and analysis of the results. The paper ends with a conclusion, which briefs the key findings and their relevance to Kenya's use of ICT in education, particularly at vocational level.

E-Education in Kenya

The general model of education in Kenya is 8-4-4 system, where a student spends 8 years of primary school, 4 years of secondary school, and 4 years of university. One deviation, a student may follow, is to enter vocational college, after secondary school with the aim to "acquire competencies and skills to meet the human resource aspirations. This aligns and blends well, according to government's Vision 2030 strategic plan, which aims at making Kenya a regional leader in ICT. The strategic plan is to make e-education a key objective by having all students provided with "virtual classrooms to enable learning through online participation"(GOK, 2007).

ICT in Public Vocational Colleges

The aforementioned research by Chris (2015), based on a survey, states that 98% of the teachers in primary schools were not trained on the computer literacy skills. According to Kenya's Ministry of Education, vocational Colleges fall under a category called Technical/Vocational Education and Training or TVET. In 2015, there were 813 TVETs in Kenya, of which majority are private.

Due to importance of TVET in professional education, the ministry had developed a "ICT lecturer competency framework and e-resource center" with the aim of expanding "open and distance learning programs", and integrating digital literacy in "all curricula for TVET" (GOK, 2013).

The emphasis of ICT across all TVETs is thus a primary goal of Kenyan government's Vision 2030 strategic plan, started in 2007.

The main aim of this research is to gauge the situation of ICT in TVETs, almost 10 years after the plan was announced, by designing a survey and collecting data from teachers through a cross section of public TVETs (i.e. vocational colleges) which are 46 in total. They are located both in rural areas outside the capital Nairobi (15 colleges) and urban areas of Nairobi itself (11).As explained below, 464 teachers, divided roughly half-and-half among rural and urban vocational collages were received. Indeed, these teachers were targeted because when taking teaching diploma (acquired in government training facility, prior to teaching in a vocational college), they are all taught computer application as one of unit to equip them with skills for teaching.

Survey Methodology

The purpose was to investigate the differences that exist based on location identifying Internet connectivity quality (speed) due to bandwidth that depends on infrastructure. Besides, more information was required to assess computer literacy of instructors and not only those teaching computer related units but also from other departments. E-education preparedness was asked of which they gave their different opinions of what they think of their respective institutions phase of actualizing it.

The colleges that were selected for the survey, belong to government and almost 90% are connected to the power grid or have alternative energy. Such platform eliminates a morsel of any excuse for lack of power to run computers and other electronic gadgets.

A list of public vocational colleges to visit was made prior to the research to have itinerary to be followed. Instructors from the colleges were key informants. They must not only hold an education degree from different fields, but more preferably an education technical diploma. As mentioned earlier while taking their respective diplomas, instructors in these vocational colleges were all taught computer application to equip them with skills for teaching. Approximately TVET public

institutions are 46 with each institution having an average of 45 instructors. This results into a total of 2,070 as the targeted instructors. Using simple random, 503 questionnaires were administered to instructors of which 464 were completely filled and returned capturing 254 from rural and 210 responses from urban areas in Nairobi.

Key Findings

Study findings were presented based on various parameter: How they access the internet; Weekly use of computers; rating the college's connection capabilities, quality and sufficiency of computers with internet; Computer skills literacy abilities and E-Education preparedness.

Instructors interviewed were from various departments like Automotive, Building and construction, Electrical, Mechanical, Clothing and Textile, Hospitality and ICT. As expected those in computer department did not need more elaboration on the questions as opposed to other departments. Through interaction while feeling questionnaire you could detect perceptions built around embracing computers. Those not working in ICT department did not have any motivation to enhance their skills in computer. They felt intimidated if they are subjected to same skills of which students they teach were learning.

Instructor's computer Literacy: Not all instructors were computer literate. This was captured when they answered the question: At what level are you able to handle and use computer? The checkboxes scale used were Excellent, Good, Satisfactory and Below expectations. Below expectations was a softer way to stating that one is computer illiterate. Satisfactory meant that the respondent had basic idea of operating computer. Comparing the literacy response, the outcome was as fig. 1 below

Computer literacy as defined by Tilvawala, Myers, & Andrade, (2009) is the ability to operate and use computer effectively to desired results. For reaching the desired levels ICT must be well utilized, meaning skills should be intensively taught by confident and well equipped instructors.

Figure 1 justifies impediment of implementing e-education depends on Instructors Computer Literacy. If they are not well trained or in-serviced on digital skills then it a major blow to implement ICT4E although other basic resources are provided. Resources required and infrastructure can be provided by the authority but when Instructors have no computer skills realizing E-education remains a dream if not elusive.

An Excellent Instructors in Urban are way below the expectations with a paltry 39.05%. This implies that even though they are thought to have infrastructure, but lack of skills makes them shy away from using computer. There is an attitude of instructors from other departments that only colleagues from ICT departments should spearhead actualization of ICT4E. Majority do lack self-motivation of looking at what they will achieve if they sharpen their ICT skills.

What makes some light at the end of the tunnel is that most instructors especially those who still have some years before they retire, are aware of the great potential that ICT brings to the learning process. They only complained of lack of effective planning by the Government and failure to be consulted in what will involve them in the long run.

Looking at quality of connection which captures Speed and reliability and bandwidth provided, still both two locations are not doing well. It is obvious that achieving very efficient connection still in a long mountain to scale. Urban managing 33.81% while rural 6.30% speaks a lot. The obvious standard connection does not hit 50% in both case meaning that connection is in dare need to be seriously looked at. Many of instructors complained on corruption between the management and Internet service providers (ISP) who give them raw deal on bandwidth. Besides the bandwidth fluctuating there were cases where both LAN and WIFI could not work due to many reasons like students using it to download heavy files or accessing YouTube files.

Pairwise correlation was used to show how strongly pairs of variables were related. In this statistical analysis STATA was used for all major variables with E_Educa as dependent variable while Int Con Qlty, Literacy and Place as independent variables. This resulted into the table below:

Table 1 Correlation E-Education against three major independent variables

	E-Education	Internet Quality	Literacy	Place
E-Education	1.0000			
Internet Quality	0.2772* 0.0000	1.0000		
Comp. Literacy	0.3148* 0.0000	0.3175* 0.0000	1.0000	
Place	0.4202* 0.0000	0.5422* 0.0000	0.5029* 0.0000	1.0000

* P<0.01

Place (Urban), Computer Literacy and Internet Connection Quality (Speed) are all significantly and positively associated with E-Education. The more developed the place is the higher chance of implementing E-Education because of improved infrastructure. This is similar if the instructor is well equipped with computer skills besides having reliable Internet connection Quality.

The Ordinary Least Square (OLS) was used for the analysis where E-Education the dependent variable (Y) with several other selected independent variables (X). In the first case IntConQlty is used as an independent variable resulting to equation

$E\_Educa = \beta_0 + \beta_1\, IntConQlty + \mu_i,$

where E_Educa is variable for E-Education assessment.

β_0:is the Intercept

β_1:is the coefficient of the variable IntConQlty,

where IntConQltyis variable for quality of Internet connectivity(Speed)

andμ_i:is the error**.**

Table 2 E-Education against Internet Connection Quality (Speed)

	Ordered ProbitEstimation	
VARIABLES	***E-Education***	***Std Error***
Internet Connectivity		
Inefficient	-0.0317	(0.148)
To Standard	0.440***	(0.125)
Very Efficient	0.839***	(0.148)
Constant cut1	-0.544***	(0.0969)
Constant cut2	0.277***	(0.0944)
Constant cut3	1.256***	(0.106)
Observations	***464***	
*** p<0.01, ** p<0.05, * p<0.1		

Inefficient, is negatively associated with E-Education. Other categories i.e. To standard and Very efficient are positively and significantly associated with E-Education. They have high impact in implementation of E-Education. The variable IntConQlty has four category variables.

Executing E-Educa against Literacy results into

$E\_Educa = \beta_0 + \beta_1\ Literacy + \mu_i$

where E_Educa is variable for E-Education.

β_0: *is the Intercept*

β_1: *is the coefficient of the variable Literacy,*

where Literacy: Computer skills that Instructors possess.

μ_i:is the error**.**

Table 3 E-Education against Computer Literacy.

	Ordered Probit Estimation	
VARIABLES	***E-Education***	***Std Error***
Computer Literacy		
Satisfactory	0.423***	(0.138)
Good	0.787***	(0.143)
Excellent	0.922***	(0.146)
Constant cut1	-0.335***	(0.103)
Constant cut2	0.503***	(0.105)
Constant cut3	1.484***	(0.117)
Observations	**464**	
*** p<0.01, ** p<0.05, * p<0.1		

All categories of Computer literacy are significantly and positively associated with E-Education. This implies that Computer literacy has high impact on implementing of E-Education in vocational colleges.

When E_Educa against Literacy and Place areestimated it develops into

$E\_Educa = \beta_0 + \beta_1\ Literacy + \beta_2 Place + \mu_i$

Table 4 E-Education against Computer Literacy and Place

Ordered Probit Estimation		
VARIABLES	**E-Education**	**Std Error**
Computer Literacy		
Satisfactory	0.162	(0.144)
Good	0.424***	(0.153)
Excellent	0.393**	(0.166)
Place (Location)		
Urban	0.815***	(0.120)
Constant cut1	-0.302***	(0.104)
Constant cut2	0.579***	(0.106)
Constant cut3	1.641***	(0.122)
Observations	**464**	
*** p<0.01, ** p<0.05, * p<0.1		

Satisfactory is positively and insignificantly associated to E-Education. This are instructors who have very minimal or basic computer literacy. They barely cannot handle computer tasks with confidence. Good and Excellent are positively and significantly associated with E-Education. If an instructor has good or excellent computer skills then the positive impact of implementing E-Education is high. The results when E-Education estimated against Place as is in table 5.

$E\_Educa = \beta_0 + \beta_1 Place + \mu_i$

Table 5 E-Education against Place

Re Regression Estimation		
VARIABLES	***E-Education***	***Std Error***
Place (Location)		
Urban	0.970***	(0.105)
Constant cut1	-0.456***	(0.0766)
Constant cut2	0.410***	(0.0756)
Constant cut3	1.465***	(0.0947)
Observations	**464**	
*** p<0.01, ** p<0.05, * p<0.1		

This shows that Urban is positively and significantly associated to E-Education. If the college is located in Urban centers, probability of embracing E-Education is high as opposed to Rural. In Urban areas infrastructure is favoring E-Education.

When multivariate independent variables are executed, it results into the table 6 correlates with majority of the above statements. E_Educa is estimated against IntConQlty, Literacy and Place.The formula will be as:

$$E\_Educa = \beta_0 + \beta_1\ IntConQlty + \beta_2\ Literacy + \beta_3 Place + \mu_i$$

Table 6 E_Educa against Multiple Independent variables

	Ordered Probit Results	
VARIABLES	***E-Education***	***Std Error***
Internet connection		
Inefficient	-0.0580	(0.150)
To Standard	0.0208	(0.141)
Very efficient	0.302*	(0.171)
Computer Literacy		
Satisfactory	0.175	(0.144)
Good	0.440***	(0.153)
Excellent	0.342**	(0.169)
Place(Location)		
Urban	0.733***	(0.138)
Constant cut1	-0.295**	(0.121)
Constant cut2	0.590***	(0.123)
Constant cut3	1.658***	(0.137)
Observations	**464**	
*** p<0.01, ** p<0.05, * p<0.1		

When the E_Educa is compared with the three major independent variables it results into

- ✓ Inefficient is negatively and insignificantly associated to E-Education.
- ✓ To Standard is positively and insignificantly associated to E-Education.
- ✓ Very Efficient is positively and significantly associated to E-Education.
- ✓ Satisfactory is positively and insignificantly associated to E-Education.
- ✓ Good, Excellent and Urban are both positively and significantly associate to E-Education

CONCLUSION

While Kenya is a shining example of pursuing ICT as a tool for development, there are still many areas for improvement. This paper looks at the impact of Internet accessibility in Kenya with regards to e-education, developing of it as a key goal of Kenya's Vision 2030 strategy.Through a survey conducted in vocational colleges, where IT is a mandatory subject, this paper tried to look into the very areas that Kenya government is aiming to improve in their attempt to become a leading ICT power in Africa, by 2030. Recently, Ministry of ICT announced Kenya Digital Economy Blueprint 2019, which included broad vision of the government to provide "universal broadband access that will drive digitally enabled services for a digital people and economy" (Kenya ICT Authority, 2019). Though this blueprint does not make reference to vocational education, it is imperative that government pay attention to it if the country need to connect the vision to practice.

In order to evaluate the situation after this fast-paced growth a survey was conducted among instructors at vocational colleges, which were selected as key informants. The survey results show that the mode of Internet accessibility and the level of service quality, with regards to e-education, are quite different in urban area colleges when compared to the ones in rural areas. Besides, the level of computer literacy of instructors differs vastly between the urban and rural area vocational colleges. A quantitative survey data analysis shows that the general readiness of e-education depends significantly on the quality of Internet accessibility and also on computer literacy of instructors. The end conclusion is that while Kenya had shown overall leadership in Africa in term of Internet accessibility, the support infrastructure needed for e-education is fundamental. Emphasis should be in terms of quality of access, connectivity and quality of computer literate trained instructors, which still does not measure up to the expected levels.

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