DETERMINANTS OF IMPLEMENTATION OF PUBLIC SECTOR PROJECTS IN KENYA: A CASE OF LAPTOP PROJECT IN PUBLIC PRIMARY SCHOOLS IN KANGUNDO SUB-COUNTY, MACHAKOS COUNTY

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ABSTRACT

One-to-one laptop programs are becoming popular across the globe. However available evidence suggests that their implementations in schools are often faced with challenges. For example, even though the government of Kenya began supplying laptops to public primary schools in 2016; reports indicate that the gadgets have not fully been put into use in many schools. Most of the empirical studies done in this area have majorly focused on the level of success and factors influencing implementation of the project and not the extent to which specific variables determine implementation of the project, thus resulting to a research gap. In order to fill this gap, study focused on the determinants of implementation of the laptop project in public primary schools in Kangundo Sub-county. The study was guided by 4 research objectives: i.) To assess the extent to which teachers' perception determine implementation of the laptop project; ii) To establish the extent to which teachers' capacity in ICT determine implementation of the laptop project; iii) To establish the extent to which availability of facilities determine the implementation of the laptop project; and iv) To establish the extent to which availability of digital subject content determine implementation of the laptop project. The study was premised on three (3) theories; Technology Acceptance Model, Constructivist Learning Theory and Resource Based Theory. The study adopted descriptive survey design. It targeted all the public primary schools, all teachers in lower primary and all the Ministry of Education officials heading the four zones that constitute Kangundo Sub-county. The study targeted all the 74 public primary schools which have 222 lower primary teachers, 74 head teachers and 4 MOEST officials making a total target population of 300. It adopted stratified random sampling in stratifying the schools into four zones and randomly selected 22 schools. All 22 school heads and all 66 lower primary school teachers of the participating schools were purposively sampled. Additionally, the 4 MOEST officials heading the four zones were included, making a sample of 92 participants. Tools of data collection included questionnaires for teachers and school heads, an interview guide for MOEST officials and an observation checklist. The data analysis was conducted using SPSS. Content analysis was adopted in analyzing qualitative data whereas descriptive statistics such as frequencies and percentages were used in analyzing quantitative data. Tables and figures were used to present the study results. The inferential analysis conducted shows that there was a significant relationship between independent and dependent variables. Both teachers' capacity on ICT and availability of facilities were found to have significant effect on implementation of the laptop project while teachers' perception and availability of digital subject content were found to have insignificant effect on the project in public primary schools in Kangundo Sub-County.

Key Words: *implementation, public sector projects, laptop project, public primary schools, Kangundo Sub-county, Machakos County, Kenya*

INTRODUCTION

One laptop per Child programs, availing one computer per learner, are becoming popular across the globe. Larkin and Finger (2011) define these programs as the availability of wireless enabled and mobile learning device for every learner in class. Infusion of technology into learning processes has proved to be effective in education as it leads to dramatic transformation in education process (Banju, 2014). Despite their huge costs relative to other pressing national needs, one-to-one laptop projects are being implemented as they are thought to have the potential of bridging the significant digital gap in the learning institutions (Mouza, 2008). For example, such initiatives have been implemented in several states in the USA and in Australia (Department of Education, 2008; Dawson, Cavanaugh & Ritzhaupt, 2009). Similarly, the World Bank's Development Index (2010) report reveals that most governments in developing countries are significantly increasing their budgetary allocations towards integrating technology in their education systems (Sharples & Moldéus, 2014).

The American OLPC organization founder Nicholas Negroponte has motivated the adoption of one-on-one computing initiatives in the developing world. In 2005, he announced the launch of the XO to the World Economic Forum (WEF) (Luyt, 2008). From 2006, his organization began selling low cost laptops directly to governments that implemented OLPC in their public schools. By 2010 the website announced that approximately two million laptops had been distributed to more than thirty countries (at about 188 USD each), the five largest deployments being in Uruguay, Peru, Argentina, Mexico, and Rwanda (Trucano, 2013; Iravo & Kabanyana, 2017). Uruguay, which is the world's first country to launch the OLPC program in all the public primary schools, declared the project a success (Trucano, 2013). Due to the success of Uruguay's laptop project, the World Bank has been instrumental in coordinating an online "ideas festival" with an aim of connecting teachers across Latin America in sharing lessons on one-to-one computing programs. However, not all countries that have implemented nation-wide laptop projects have had similar success stories.

In 2006, Project UCA was adopted by the Brazilian government, with an aim of providing a laptop to each learner and teacher in public schools in phases. However, the program has not been implemented successfully. Lavinas and Veiga (2013) who evaluated the project noted that teacher training in ICT was inadequate. As a result, they established that 20% of teachers were yet to use the new gadgets in teaching a year after the program was launched thus demonstrating how teachers' ICT skills can impact on implementation of an ICT project such as the laptop project.

The Peru government initiated frameworks for implementation of digital literacy project in schools by ordering the procurement of over 600,000 laptops for consumption by children in rural primary schools. However, Warschauer (2010) reports that the program faced infrastructure challenges such as electricity and lack of modern buildings.

The trend realized in the above studies indicate that implementation of the laptop projects in elementary South American schools faced a myriad of challenges which included; too much curriculum to cover, anticipated increase in teacher workload, inadequate time on their daily routines, adoption of different teaching styles, and standardized testing (Zucker & McGhee, 2005; Penuel, 2006).

The introduction of computers in schools in Malaysia recorded serious challenges in the resource allocations, curriculum development, teaching practices and rearranging of the basic structures in the learning institutions (Merrow, 1995). A decade later, it appears that the country has been able to overcome these challenges. For example, Ghavifekr & Rosdy (2015) established that the ICT project was successful mainly due to presence of well-established infrastructure, teacher training and preparedness.

Similar technology projects have also been implemented in some African countries. For example, in 2007, the government of Rwanda partnered with OLPC to deploy low-cost, low-power, connected laptops in her primary schools (Luyt, 2008). The project had managed to distribute more than 115,000 computers in the schools by 2013. In 2017, Iravo and Kabanyana conducted a descriptive survey on "factors influencing successful implementation of the laptop project" in Gasabo District of Rwanda. The survey results indicated that majority of teachers did not have basic IT skills and that they were not equipped with IT curriculum. The study concluded that Rwanda was not e-ready for the laptop project. It can be argued from the foregoing that nationwide ICT projects often face implementation challenges.

In Kenya, the plan to integrate ICT in education sector came as one of the development agendas by Jubilee government during 2013 presidential election campaigns (Barmao, 2014). Although the laptop project was conceived in 2013 with an aim of delivering laptops to schools in 2014, delivery was delayed by challenges to 2016 (Nyamai & Wanzala, 2018). The revised target aimed at providing all class one pupils in every public primary school with laptops by the end of 2016. However, only 82.6% of the learning institutions all over the country had been supplied with over a million tablets.

This study looks at the Jubilee laptop implementation project with more emphasis on the period after delivery of the laptops in primary schools. Even though the project has received a lot of public attention, initial evidence suggests that researchers, albeit few, have concentrated on the pre-delivery phase of the project (Barmao, 2014; Banju, 2014; Mose, 2014; Sharples & Moldéus, 2014; Wafula, 2015; Kosgei, 2015). These researchers have found out that corruption, procurement bottlenecks, power supply, infrastructure challenges, capacity of teachers, teachers' perceptions, and insecurity among others to be some of the factors that were making schools not to be e-ready or government to delay the project. Research at the post-delivery phase is at its infancy stage. Only Mubichakani, Ronoh and Rotich (2018) and Sutter and Kihara (2019) have investigated factors that influence the project's implementation after the government delivered 82.6% of the target laptops to schools. This study was motivated by the need to provide

additional knowledge on the determinants of implementation of the laptop project in primary schools.

A report by the KICD reveals that, although the laptops have been delivered in learning institutions, very few have been put into use. (Nyamai & Wanzala, 2018). The report concludes that teachers are either unwilling to integrate ICT or they lack capacity. Another report by the TSC indicates that over 80% of teachers lack enough skills in ICT (Nyamai & Wanzala, 2018). Lack of capacity can affect their perception on computers, and as a consequence, fail to put computers into use (Mubichakani, Ronoh & Rotich, 2018). It can therefore be concluded that Kenyan teachers may not be adequately equipped with ICT skills that are relevant in the implementation of the project.

Teachers' perception on computers can determine how they implement an ICT program. Research shows that the use of computers in a learning environment is strongly related to teachers' perceptions (Larkin & Finger, 2011; Penuel, 2006). For example, Ertmer (2005) opines that decision by teachers to integrate ICT largely depends on the beliefs they hold concerning technology and academic success of the learners. Ertmer found out that teachers willingly chose not to implement computer technology if they did not see the relevance in the resource. This view is well grounded in theory. For example, Fred Davis (1985) Technology Acceptance Model (TAM), which the current study is premised on, explains that users of new technology system can be motivated by their PU which is the level of believe that adopting a specific technology would help in enhancing their performance. This study assessed the extent to which teachers' perception on computers determines implementation of the laptop project in Kangundo Sub-County public primary schools.

Prior experience with ICT in education has demonstrated that integrating ICT into the traditional curriculum is not always a smooth process (Tabb, 2008). Among the factors that have hindered technology adoption are improper training and familiarization of teachers to technology. Therefore, teachers need to have adequate training in application of ICT in education. According to Pittman, McLaughlin and Bracey-Sutton (2008), the most crucial element in integrating technology in teaching is the teacher's capacity. This study assessed the extent to which teachers' capacity in ICT determines implementation of the laptop project in Kangundo Sub-county public primary schools.

Research has shown that resources and facilities are instrumental in providing services that require interaction of people in different ways. For instance, Liang et al (2005) suggest that there should be various components in a classroom if it has to be termed as a computing environment appropriate for the laptop project such as: laptops; device storage system; server space; and a data projector. Mingaine (2013) adds that facilities such as electricity, buildings, purchase of both hard and software are key to successful implementation of any ICT project in schools. Makinia (2014) maintains that a decision to adopt a new technology in schools will depend on the availability of electricity power due to the fact that computers require it for their

functionality. This study established the extent to which availability of facilities determines the implementation of the laptop project in public primary schools in Kangundo Sub-county.

Content development is an enormous task that can serve as a hindrance to the implementation of the laptop project. According to Kosgei (2015), there is limited development of digital curriculum content in Africa that meets the standards of national curriculum framework. In South Africa, for example, developing curriculum-aligned content offered in different subjects in her schools is a specialty of Learning Channel and Mindset Network. The Mochudi Media Centre in Botswana also builds capacity on teachers on the use of digital content. Mucheru (2016) revealed that all schools were to be provided with internet connectivity to enable the laptops to be updated with the latest software, curriculum materials and other approved content. The study aimed at establishing extent to which availability of digital subject content determines implementation of the project in Kangundo Sub-county public primary schools.

STATEMENT OF THE PROBLEM

A countrywide survey on the implementation of the laptop project by Daily Nation report indicates that majority of schools across the country have not put the laptops provided by the government into use (Nyamai & Wanzala, 2018). Reports obtained from the Sub-county Director of Education in Kangundo (2019) indicate that there is poor adoption of the laptop project in the sub county's primary schools even after the government delivered laptops to all of them in 2017. The report specifically identifies; lack of enough time allocation, lack of adequate infrastructure, unavailability of ICT subject content of the new Competency Based Curriculum, low perception of teachers towards computers, understaffing, low ICT skills among teachers and inadequate government financing to the project to be key hindrances to the implementation of the laptop project. To make the project a success, the government of Kenya has enhanced electricity in all primary schools, trained one teacher in every school so as to cascade the same training to the of rest of the staff, delivered the laptop gadgets to schools, and provided funds to schools to modify existing classroom into computer strong room and install electricity to the classrooms. Even with all these government efforts, schools have not fully put these laptops into use long after they were delivered in May 2017. Whereas there are empirical studies to explain the success of the implementation of the project in other areas (Barmao, 2014; Banju, 2014; Mose, 2014; Sharples & Moldéus, 2014; Wafula, 2015; Kosgei, 2015; Mubichakani et al., 2018), there is limited empirical study that has been conducted in public primary schools in Kangundo and more especially after delivery of the laptops. Also, most of the studies done on this areas have majorly focused on determining the level of success and factors influencing implementation of the project and not the extent to which specific variables determine implementation of the project, thus resulting to a research gap. Therefore, this study focused on the determinants of implementation of the laptop project to fill this gap.

OBJECTIVES OF THE STUDY

1. To assess the extent to which teachers' perception determine implementation of the laptop project in Kangundo Sub-County.
2. To establish the extent to which teachers' capacity in ICT determine implementation of the laptop project in Kangundo Sub-County.
3. To establish the extent to which availability of facilities determine the implementation of the laptop project in Kangundo Sub-County.
4. To establish the extent to which availability of digital subject content determine implementation of the laptop project in Kangundo Sub-County.

EMPIRICAL REVIEW

Implementation of Laptop Projects

Implementation of the laptop project in basic learning institutions has been adopted by many countries all over the world. The adoption was motivated by the American OLPC organization founder Nicholas Negroponte who in 2005 announced the launch of the XO to the World Economic Forum (Luyt, 2008). This was followed by the launch of OLPC program by Uruguay in all her public primary schools with much success (Trucan, 2013). Due to the success of the project in Uruguay, other countries were motivated in implementing such projects in Latin America with the World Bank being instrumental in coordinating an Online Ideas festival with an aim of connecting teachers across Latin America in sharing lessons on one-to-one computing programs. The Brazilian government adopted the project in 2006 though without much success as teachers lacked adequate ICT skills (Lavinas & Veiga, 2013). The programme was also introduced in Malaysia but recorded serious challenges in terms of resource allocation, curriculum development, and basic infrastructure (Merrow, 1995). Closer home in Rwanda, the project was implemented in 2007 with the Rwandese government partnering with OLPC to deploy low-cost, low-power, connected laptops in her primary schools (Luyt, 2008). By 2013, the project had managed to distribute more than 115,000 computers in the schools. However, study done by Iravo and Kabanyana (2017) indicated that Rwanda was not e-ready for the laptop project as majority of the teachers did not have basic ICT skills and were not equipped with IT curriculum. This impacted on the teachers' perceived ease use resulting to low perception.

Kenya's rollout of the laptop project was influenced by the desire to achieve vision 2030 development agenda which acknowledges the crucial role played by technology in enabling development of education, thus anchoring some of the critical aspirations on the presence of computers in schools. This is according to Murang'a University of Technology Institutional Repository which also affirms the existence of education policy on technology as entrenched in three policy documents which are; "e-Government Strategy, National ICT policy and sessional paper No. 1 of 2005" (Mariga, Ogenga, Shikali, & Muliaro, 2017).

The e-Government strategy as adopted in 2004 focused on digitalization of government operations. The main objective was to minimize duplication in public sector and promote efficiency in utilizing the available resources. This would lead to improvement in the level of competitive position of the country through effective service delivery and providing information promptly (Mungai, 2017). For this objective to be achieved, the e-Government strategy emphasized on using education in equipping the population with the adequate skills and competencies in ICT as well as other relevant innovations.

The National ICT Policy was aimed at facilitating sustainability in the growth and development of the economy by use of relevant technologies. The policy emphasized on integrating technology in education sector, thus establishing sharing of education resources and promoting e-learning (Ministry of ICT, 2016).

The main objective of Sessional Paper No. 1 of 2005 "A Policy Framework for Education, Training and Research" was to achieve universal education by 2015 (MOEST, 2005). The aim was to promote accessibility, equity, equality and also ensure quality in delivering education services. This would be achieved by the government's commitment to integrate ICT in education. This would go a long way in mitigating most challenges faced in the education sector including high pupil to teachers' ratio, and high cost of learning materials especially textbooks. It is from the three documents that implementation of laptop projects in primary schools was conceptualized by Jubilee government.

However, the Murang'a University of Technology Institutional Repository identifies key determinants to the implementation of technology projects as; ICT integration in operations and programs, adequate financial and human resources, appropriate learning facilities and/or infrastructure and adequate number of trainers in modern technology.

According to Grimes & Warschauer (2008), introducing the use of laptops in education sector greatly impacts on the learners' accessibility and information use as well as data in learning. The two scholars hold to the fact that computer applications with necessary content and teaching features greatly improves the ability and efficiency of teachers. However, the above notwithstanding, Swarts and Wachira, 2010, opined that ICT implementation would be hindered by lack of adequate infrastructure, inadequate facilities in schools, and inadequate skills for ICT integration. Mendes, Tuijnman, & Young (2003) and Hare (2007) in their work depicted a potential gap between the projected and achieved level of implementation.

Teachers' Perception and Implementation of the Laptop Project

According to Eyo, Joshua and Esuong (2010) perception is a predisposition which develop through long and complex process. They explain that perception is a level of preparedness for a given activity. Teachers' perception on computers can determine how they implement an ICT program. De Young and Spence (2004) indicated that teachers were not willing to embrace technology in teaching. Resistance, according to Yushau (2006), is connected with a

dehumanizing effect, demoralization and feeling of obsolescence. The forgoing can suggest that teachers may have low perception on computers when they are not familiar with computers or when they feel they lack competency and this can affect their decisions to use computers in their teaching processes.

According to research, use of computers in a learning environment strongly relates with the closeness the usage can be linked to teachers' perception and beliefs (Larkin & Finger, 2011; Penuel, 2006). Although some teachers show high enthusiasm towards the use of technology in the classroom, others do not. (Silvernail et al., 2011). For example, Ertmer (2005) opines that the readiness to adopt technology is depended on the fundamental belief that teachers have on achievement of the learners. He found out that teachers willingly chose not to implement computer technology if they did not see the relevance in the resource. This view is well grounded in theory. For example, Fred Davis (1985) TAM, which the current study is premised on, explains that users of new technology system can be motivated by their PU which is the level of believe that adopting a specific technology would help in enhancing their performance.

Chen (2008) conducted a study to investigate why teachers were not willing to integrate ICT teaching. The survey was carried out in a high school in Taipei City because it had the highest level of ICT integration in Taiwan. According to the study, there was a lot of pressure from education stakeholders for the Taiwanese students to achieve success. Thus, use of technology was perceived as diversionary from the major objective of the learning institution, which was to help the learners pass their examinations. The findings of this study demonstrate that external factors such as pressure for high performance and increased workload for teachers can make them develop low perceptions towards integrating technology into learning. This study will assess whether increased teacher workload due to staff shortage and increased pressure could be having a bearing on teachers' perception on the use of laptops in teaching process.

Blau and Peled (2012) carried out a study to evaluate teachers' readiness to change and perceptions on ICT in Northern Israel. This involved comparing three different groups of tutors that: (1) used laptops in teaching, (2) received laptops for use from the state, and (3) taught using traditional methods. The study involved 97 teachers as participants from three different secondary schools. The results showed that instructors in the first case consumed more time in preparing for technology-based lessons compared to the other two cases. These findings could indicate that teachers have developed low perceptions on integrating ICT in their learning processes. For example, Davis (1985) Technology Acceptance Model hypothesizes that users of technology may be motivated to use a new technology due to their PEOU which is the extent to which they believe that limited effort would be required in using that particular technology.

Iravo and Kabanyana (2017) also noted teachers' perception as a factor while carrying out survey on factors influencing successful implementation of the laptop project in Gasabo District of Rwanda. Their study was motivated by the fact that Rwanda was the leading country in

implementation of the project in Africa having already distributed over 115,000 computers in her primary schools by 2013.

Mubichakani, Ronoh, & Rotich (2018) emphasize that teachers must have high perception on computers for them to adopt computer technologies. He reports that low levels of enjoyment, and confidence as well as computer anxiety have a bearing on teachers' perception on computers and their use. The foregoing can suggest that a negative perception can signal lack of unwillingness for an intended activity and vice versa. This study investigated whether teachers' perception on computers hinder them from implementing the laptop project.

Sutter and Kihara (2019) investigated determinants of successful implementation of digital literacy project in Baringo County's public primary schools. The study employed Yamane formula to sample 150 MOE stakeholders who included: Sub county Directors, the TSC Sub County Directors, curriculum support officers in the County, the Kenya Institute of Special Education Sub County coordinators, the Kenya Primary Schools Head Teachers Association Sub County coordinators, the Kenya National Union of Teachers Sub County coordinators and the head teachers of the schools. Structured questionnaire presented in Likert scale were used in collecting primary data. The study concluded that teacher's perceptions on ICT affect the implementation of digital literacy learning program and suggested that there should be professional development training programs for teachers to enhance their competence. However, this study did not sample subject teachers whereas they are key implementers of learning programs. The current study included teachers to fill that gap. This study assessed whether Kangundo Sub-county primary teachers consider using the tablets they were provided with as time consuming and thus, low usage in their teaching processes.

Teachers Capacity and Implementation of the Laptop Project

Prior experience with ICT in education has demonstrated that integrating ICT into the traditional education curriculum is not always smooth (Tabb, 2008). Among the factors that have hindered technology adoption are improper training and familiarization of teachers to technology. Therefore, necessary skills regarding the use of ICT should be impacted on teachers. Pittman, McLaughlin and Bracey-Sutton (2008) observed teacher's capacity in the use of technology as the most essential factor for enhancing learning process.

In 2010, Greaves and colleagues carried out a study in 997 schools in the US. The scholars identified several factors that contribute to improvement of performance in schools that have adopted laptops in the learning process. Of the factors established, allocating adequate time for training teachers and sharing experiences as well as collaborating with their peers was deemed the most important. These findings reinforce arguments that training of teachers in ICT skills can determine implementation of the laptop project such as in the Kenya's case.

In 2006, Project UCA was adopted by the Brazilian government, with an aim of providing a laptop to each learner and teacher in public schools in phases. The program has not been

implemented successfully. Lavinas and Veiga (2013) who evaluated the project noted that teacher training in ICT was inadequate. They established that training of teachers was to take place in five modules; with the first module consisting of 40 hours of in-class training. The remaining 4 modules were designed to be delivered through the Project's online portal. However, not all schools had access to connection to the internet thus, greatly affecting the quality of training. They reported that 80% of teachers who were trained faced challenges in using the laptops in teaching. As a result, they established that 20% of teachers were yet to use the new laptops in teaching thus demonstrating how teachers' capability can impact on implementation of an ICT project such as the laptop project.

In 2007, Rwanda partnered with OLPC to supply cheaper and power efficient laptops in her primary schools (Luyt, 2008). The project had managed to distribute more than 115,000 computers in public primary schools in 2013. In 2017, Iravo and Kabanyana conducted a descriptive survey to "determine factors influencing successful implementation of the project" in Gasabo District of Rwanda. The study employed cluster sampling technique to sample 36 head teachers, 36 ICT teachers, 36 finance officers and purposive sampling to include 17 MOE officials making a sample size of 125 participants. The study results indicated that most teachers lacked capacity in basic IT skills and that they were not conversant with IT curriculum. The study concluded that Rwanda was not e-ready for the laptop project. However, the study was delimited to obtaining responses from stakeholders but the current study sampled teachers who are the real implementers of any learning program.

In realization of the power of technology to transform learning processes, the Tanzanian government has been integrating ICT in secondary school education. To build the ICT, the MOE has been training and equipping teachers in secondary schools with the skills of integrating ICT in learning processes (Ngeze, 2017). The mode of training used is cascading whereby master trainers are trained in order to train other teachers in the schools. This approach can be implemented in other countries facing severe teachers' ICT skills gap.

The laptop project, according to Banju (2014), was expected to start at the beginning of 2014 by which time, 50,000 tutors would have been impacted with ICT skills which included assembling the devices, applications upload, and development of content. Early evidence suggests that the training may not have occurred or it was poorly delivered. Mose (2014) revealed that Kenyan teachers were ill equipped with technology skills and equipment due to lack of clear structures of teacher training on educational technology. Similarly, a study by Barmao (2014) on challenges and opportunities for laptops for pupils in public primary institutions conducted in the Municipality of Eldoret indicated lack of training and capacities among instructors as some of the factors hindering implementation of the project.

Another study by Sharples and Moldéus (2014) on e-readiness and governance conducted in Kenya showed that there were only very few teachers (8%) who felt that they had the capacity required to integrate ICT in the teaching process and that majority (60%) felt the need for

additional practice and training before introducing ICT in the learning process. This shows that teachers may not be able to implement any ICT related program if they lack ICT knowledge and skills. This study will aim at establishing the extent to which teachers' capacities in ICT skills determine implementation of the laptop project in Kangundo Sub-county.

Similarly, Banju (2014) conducted a descriptive study on "factors influencing implementation of the laptop project in public primary schools" in Nairobi City County. The study sampled 19 primary schools. All the 19 head teachers were purposively sampled, 3 teachers from each school was randomly sampled totaling to 76 respondents. The study also randomly sampled 30 MOE officials and 10 KICD officials. In total, the study included 116 participants. It adopted a questionnaire to collect data from the tutors while KICD and MOE officials were interviewed using an interview guide. The study results showed that 80% of teachers had no ICT skills. However, this study was conducted in 2014 when the laptop project was at its conception stage implying that the government may not have had trained teachers then. The present study assessed whether teachers have been trained on ICT to implement the laptop project and whether the training is adequate.

Recent evidence in Kenya suggests laptops are not in use and the problem can partly be attributed to lack of teachers' capacity in ICT. A Teachers' Service Commission (TSC) report (2018) indicates that over 80% of teachers have inadequate skills in ICT (Oduor, 2018). Connected to this report, another report by the KICD (2018) reveals that, although public learning institutions have ICT facilities, very few have put these tools to use in enhancing the learning process. (Wanzala & Nyamai, 2018). Research conducted by other scholars in this section has shown ICT skills gaps in Kenyan teachers. The study undertook to establish the extent to which teacher's' capacity in ICT skills determine implementation of the project.

Availability of Facilities and Implementation of the Laptop Project

Research has shown that resources and facilities are instrumental in providing services that require interaction of people in different ways. For instance, Liang et al (2005) suggest there should be various components in a classroom if it has to be termed as a computing environment appropriate for the laptop project such as: laptops; device storage system; server space; and a data projector.

In 2013, Mingaine argued that facilities such as electricity, buildings, purchase of both hard and software are key to implementation of any ICT project in learning institutions. According to Makinia (2014), a decision to adopt a new technology in schools will depend on the availability of electricity power due to the fact that computers require electricity power for their functionality. The present study assessed if primary schools in Kangundo Sub-county have enough secured rooms customized for laptops devices, laptop storage facility, customized desks for laptops, and uninterrupted power supply.

While many countries are recognizing the need to infuse technology into learning processes, evidence suggests that there are several infrastructure challenges hindering schools from implementation technology projects. For example, in South America, Peru government initiated frameworks for implementation of digital literacy project in schools by ordering the procurement of over 600,000 laptops for consumption by children in rural primary schools. However, in 2010, Warschauer reported that the program faced infrastructure challenges such as electricity and lack of modern buildings. The current study focused on Kangundo Sub-county's public primary schools and sought to establish whether availability of rooms and electricity determine the implementation of the laptop project.

The introduction of computers in schools in Malaysia recorded serious challenges in the resource allocations, curriculum development, teaching practices and rearranging of the basic structures in the learning institutions (Merrow, 1995). For example, Ghavifekr & Rosdy (2015) researched on the level of integration of technology in Malaysian schools. The study collected views from teachers in Kuala Lumpur on the implementation of ICT project in the schools. It established that the ICT project was successful mainly due presence of well-established infrastructure, teacher training and preparedness. However, this study cannot be adopted in generalizing the findings in Kenya. This is because Malaysia is more developed and therefore, its economy is not similar to that of Kenya. Therefore, there is a contextual gap and thus, there was need for this current study to fill this gap.

Even though Tanzania has not implemented laptop project in public primary schools, Ngeze (2017) reports that the country has integrated ICT into secondary school learning and administration. He notes that adoption of ICT in education sector is still low as many factors act as hindrance. Malero, Ismail and Manylizu (2015) investigated the willingness to use ICT for secondary learning institutions in Tanzania's Dodoma Municipality. During this study, 7 and 9 private and public secondary schools respectively were sampled. Data was collected from teachers in every school through filling of questionnaires. The study results indicated lack of ICT facilities in the schools as major factor contributing to low implementation of ICT. However, this study focused on secondary schools while the present study assessed the same phenomenon in primary schools.

In Kenya, the implementation of laptop project has faced similar infrastructural challenges. For example, the government shifted from issuing laptops to tablets for class one pupils. This policy shift was informed by budget cuts. On infrastructure readiness, there have been media concerns over poor infrastructure in primary schools, especially in the rural setup. For example, questions arose on priorities such as access to food and water in some rural areas in relation to the project. Even though government statistics indicate that 95% of primary schools are connected to power supply, power outages are frequent in rural villages.

Lack of facilities such as proper power supply, and customized classrooms have been found to slow implementation of laptop project in Kenya (Sharples & Moldéus, 2014). In 2017, Muriithi

conducted a study to interrogate the key factors for success in implementation of digital literacy projects in Kajiado North Sub-county. According to the study, inadequate infrastructure was one of the main issues that were leading to the failure of the project (Muriithi, 2017).

Digital Subject Content and Implementation of the Laptop Project

In Malaysia, serious challenges were noted among them being curriculum development and teaching practices. Ghavfekr and Rosdy (2015) observed that the country was able to overcome these challenges a decade later majorly through well-established curriculum development programs. This is an indication that Digital Content development is an enormous task and can easily hinder the implementation of the laptop project.

According to Kosgei (2015), there is limited development of digital curriculum content in Africa that meets the standards of national curriculum framework. In South Africa, for example, developing curriculum-aligned content offered in different subjects in her schools is a specialty of Learning Channel and Mindset Network. The Mochudi Media Centre in Botswana also builds capacity on teachers on the use of digital content. Mucheru (2016) revealed that all schools were to be provided with internet connectivity to enable the laptops to be updated with the latest software, curriculum materials and other approved content.

In Kenya, KICD is tasked with preparing digital content. According to information available at the ICT Authority that is charged with implementation of the laptop project, the Laptop projects delivered to primary schools were preloaded with interactive digital content for pupils in standard one and two. The digital content was to cover the 5 subjects taught in primary schools which are, Mathematics, English, Kiswahili, Science and Social Studies. The content was created by KICD. However, with shifting from the 8-4-4 system to Competency Based Curriculum, it is yet not clear whether the new curriculum digital content is available.

Unavailability of the new CBC content could completely stall the integration of ICT into learning processes. Considering that TAM by Davis (1985) posits that technology users make decisions based on their PU, devices loaded with old curriculum content may be deemed not useful by teachers. Research on how digital content determines implementation of laptop project at this level is limited. Thus, this study aimed at establishing the extent to which availability of digital subject content determines implementation of the project in Kangundo Sub-county public primary schools.

THEORETICAL FRAMEWORK

Technology Acceptance Model (TAM)

This study will be premised on TAM which was advanced by Fred Davis in 1985. He argued that technology use can be explained better by the level of motivation among the users. This in turn depends on external factors such as system features and capacities. According to Davis, three factors explain motivation among the users. These are PU; PEOU; and perception on system use.

Davis defined PU as the level of believe that adopting a specific technology would help one in enhancing performance while PEOU was referred to as the extent to which people believe that limited effort would be required in using that particular technology.

In 1985, Davis hypothesized that the perception among the users of a system was key in determining putting it into use. Thus he believed that perception on the use of a system greatly depended on PU and PEOU. This assumption still holds in the current study. Literature review indicated that teachers were unwilling to integrate technology in their teaching processes when they considered doing so would be time consuming. From this perspective, it can be argued that when teachers consider assembling the laptop gadgets for a class time consuming and wastage of their teaching time, they may result to not using the gadgets. From TAM, this can be viewed from the perspectives of PEOU. Also, literature review has indicated that Perceived Usefulness influences teachers' willingness to integrate ICT in their teaching process. For example, Ertmer (2005) found out that teachers willingly chose not to implement computer technology if they did not see the relevance in the resource.

The theory was later developed to involve behavioral change as a variable that directly depended on the PU (Davis, Bagozzi and Warshaw, 1989). They opined that in some cases, individuals would form strong behavioral intentions towards adoption of a system even without forming perceptions. In 1996, both Venkatesh and Davis further modified the model by doing away with attitude construct and retaining behavior intention construct. The scholars brought additional changes to the theory such as considering some other external parameters that might have influence on the perception of someone on a system. These additional variables are characteristics of a system, training of the users and participation among the users in the process of integration. This development can be seen to take care of the other remaining variables of the present study: teacher training, facilities and curriculum content. For example, system characteristics can be viewed as the facilities that should be provided to ensure the laptop project is implemented. On user training, it can be seen to refer to teachers' training on ICT and user participation in design can be seen as the need for teachers to be involved in development of the digital subject content. The TAM model remains relevant to the present study as it explains the four factors that may influence implementation of the laptop project in schools and therefore guided the study.

Constructivist Learning Theory

The study is also premised on the Constructivist Learning Theory which was advanced by Benjamin Mako Hill in 2008 while exploring the XO laptop's OS philosophy by Nicholas Negroponte, and the OLPC project. According to him technology describes the terms adopted by the learners in communicating, collaborating, creating and learning. However, the terms are dictated by individuals who are able to change the software, those who can access laptops, relevant sources for making changes and the freedom of sharing and collaborating.

Earlier in 1980, Seymour Papert had argued that through computer training, pupils are able to think and learn on their own. However, this can only be achieved by a teacher who is able to help the learner in solving problems and learning through inquiry. The teacher should be able to interpret learning information in such a way that it is appropriate to the learner's understanding. The digital content should also be arranged in an elaborate manner to ensure that pupils build on what they have been learning (Papert, 1980). The same view was shared by Palmer in 1997 who opined that for teachers to interact constructively with learners, they should be equipped with the necessary skills which should however be coupled with conducive environment, proper digital subject content, readiness and the willingness to engage (Palmer, 1997).

The constructivist learning theory by Benjamin Mako Hill suggests that in today's schools, educators and not students are responsible for creating conducive learning environments, developing curriculum, making decisions concerning relevant tools and choosing the pedagogies. Thus the theory suggests that for the learner to benefit from the project there should be conducive environment and the right content which boils down to teachers' capacity in ICT, their perceptions, proper facilities and digital subject content.

Resource Based Theory

The study is further premised on Resource Based Theory advanced in 1984 by Wenerfelt and Rumelt, and improved by Barney in 1986. The theory suggests that for organizations to successfully implement on their programs, there has to be inbuilt capacities in terms of capabilities and resources (Wernerfelt, 1984; Rumelt, 1984; Barney, 1986). In 2001, Barney expounded further the type of resources to both physical (in these case laptops and capabilities (ICT skills). According to Barney (2001), implementation of any organization's project heavily relies on the combination of the two sets of resources. Since then, it has become one of the most adored approaches to the implementation of projects.

Peteraf and Bergen (2003) also shared the same idea with Barney (2001) that organizations implement projects based on their capabilities and availability of resources (Peteraf and Bergen, 2003). The argument by the above scholars was also supported by Sirmon & Hitt (2003) who provided understanding on the independent variable of availability of resources. Sirmon & Hitt argued that the availability of facilities can have a bearing on the implementation of programs in an organization and ultimately affect the overall performance of the program (Sirmon & Hitt, 2003). When an organization has the required facilities and staff with relevant skills, then implementation of the intended project becomes a success. From the aforementioned, it can be argued that for the successful implementation of the laptop project, there has to be inbuilt capacities which include facilities such as laptops, power supply, and customized classrooms and also capabilities which include teachers' capacity and perception.

RESEARCH METHODOLOGY

Research design

Research design is the structure of a research or"glue" that holds together the research elements (Kombo & Tromp, 2006). Descriptive research design was adopted in this study. It was preferred as the study intended to describe how the aforementioned variables determine the implementation of the laptop project in Kangundo Sub-county's public primary schools.

Variables of Analysis

The variables of this survey are implementation of public sector projects, a case of laptop projects as the dependent variable with the percentage of schools using the laptops and project sustainability as the indicators. It is a function of teachers' perception, teachers' capacity in ICT, availability of facilities and digital subject content.

Site of the Study

The scope area of the study is Kangundo Sub-County, Machakos County. It is located in the lower eastern region of Kenya with a population of 218, 557 people (according to 2009 census). The sub-county has 74 public primary schools which have been classified into 4 educational zones; Manyatta, Kakuyuni, Kawethei and Kangundo central (Kangundo Sub-county educational office, 2019). The study focused on the implementation of laptop projects in these primary schools.

Target Population

The study adopted definition of target population as the number of people that are targeted in generalizing the findings of the study (Mugenda & Mugenda, 2003). The study targeted all the 74 public primary schools in Kangundo Sub-County. Each of these schools has 3 lower primary teachers, resulting to 222 teachers. Each of the 74 schools also has one head teacher, resulting to 74 school heads. Considering that these schools are divided into four zones, there are 4 MOEST officials manning the zones. This resulted to a target population of 300 people.

Sampling Techniques and Sample Size

Sampling is the process or technique of selecting a suitable representative part of a population that is used in determining characteristics of the total population (Kothari, 2008). The study employed the formula that specifies a sample of 10% as a representative of the larger population and a sample of 30% to be drawn from a smaller population (Mugenda and Mugenda, 2003). The Sub-County has 74 public primary schools stratified into four zones. 30% of the schools in each zone were randomly sampled, making a total of 22 schools. The study purposively included all the three lower primary teachers in each school, making total of 66. Head teachers of the selected schools were purposively sampled making a total of 22. MOEST officials heading the four zones were also purposively sampled resulting to 4 officials. This gave a total of 92 respondents.

Research Instruments

The study adopted semi-structured questionnaires and interview guides. The semi-structured questionnaires helped in collecting data from the school heads and class teachers while MOEST officials were interviewed using the interview guides. Additionally, observation checklists which contained a list of items to be observed aided in collecting data.

Data Collection

Primary data, which the study made use of was collected through filing of semi-structured questionnaires, conducting interviews and filling observation checklists. The questionnaires were dropped and picked at a later date. The researcher engaged the respondents in both face to face and telephone interviews and also observed items on the observation checklist.

Data Analysis

According to Kothari and Gaurav (2014*)*, the most preferred approach for reporting descriptive survey results is through development of frequency distribution tables, calculation of percentages and tabulation of the findings. After receiving the completed questionnaires, the researcher inspected all of them for completeness and suitability for coding. The qualitative data collected using questionnaires was subjected to content analysis. The collected data was organized, sorted out, coded and analyzed into themes as per the objectives. Quantitative data was captured through Ms Excel computer software and exported to SPSS computer package for analysis. Descriptive statistics was then used in analyzing the data. The study results were presented using tables and figures. The study used Pearson's correlation model below to test the degree of association. The study adopted the following regression model;

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \epsilon$$

Where: Y= Implementation of laptop projects; β_0= Constant value; X_1= Teachers' perceptions; X_2= Teachers' Capability; $_3$= Availability of facilities; X_4= Digital subject content; ϵ = Error Term

RESEARCH RESULTS

Teachers' Perception

Table 4.3 shows that 68.5% (63.4% and 5.1% agreeing and strongly agreeing respectively) of the teachers have high perception on the use of laptops in teaching. In terms of the level of project rollout, 48.2% of the respondents feel that the process of implementing laptop project has been low. This is also affirmed by 15.7% of the teachers who feel that the level of project rollout has been very low. Figure 4.5 shows that 70.5% of the teachers prefer digital teaching as compared to 45.9% who prefer traditional teaching. A higher preference for digital to traditional teaching confirms results which show that 68.5% teachers have high perceptions towards computers.

Teachers' capability on ICT skills

The research findings show that 85% of the teachers have been equipped with ICT skills. In terms of approaches of training on ICT skills, 67.2% of the teachers have been trained by ICT coordinators from the ministry of education. In terms of appropriateness of the acquired ICT skills, 62.3% of the teachers who have been trained on ICT skills feel that these skills are not appropriate for implementation of the laptop project. The study shows that 100% of the head teachers agree that the Ministry of Education conducted training on ICT prior to implementation of the project. Based on this, 59.1% of head teachers observe that all the three lower primary teachers were trained, 13.6% observe that 2 teachers were trained while 27.3% observe that it is only one teacher who was trained in their schools. On the level of agreement among the head teachers on competency in ICT skills, 39.9% of the head teachers agree that their lower primary teachers are competent in ICT skills, meaning that 65.1% of the teachers are not competent in ICT skills.

Availability of ICT facilities

The researcher sought to determine the ICT facilities available in public primary schools in Kangundo Sub-County. The study findings show that although the school were supplied with the laptops, tablets, projectors, routers and are connected to power supply, 52.5% of them do not have digital customized classrooms while 26.2% and 23.0% do not have spacious classrooms and strong rooms for storage respectively. On teacher view on whether the facilities supplied are adequate, 52.5% feel that they are not adequate. Accordingly, 45.5% and 27.3% of head teachers observe that their school do not have digital customized and spacious classrooms respectively. The results also reveal that 68.2% of head teachers feel that more facilities are required. According to them, provision of adequate and appropriate furniture as well as building additional spacious classrooms can help in making the project implementation a success. The physical audit of facilities reveals same trend with observation that 40.9% of the schools lack ICT customized rooms.

Availability of digital subject content

The researcher also sought to know whether the laptops have digital subject content. According to the study, 83.6% of the teachers agree that the supplied gadgets have digital subject content. Out of this, 67.2% of the teachers feel that the available digital subject content is inadequate with only 32.8% feeling that it is adequate. 68.2% of the head teachers feel that the digital subject content is not relevant to the syllabus with also 31.8% of them feeling that the subject content is not interactive. According to the findings, 59.1% of the head teachers feel that the content is not appropriate.

INFERENTIAL STATISTICS

The researcher adopted regression analysis in estimating the relationship between dependent and independent variables. The beta coefficients give the rate of deviations or change on the dependent variable (Implementation of the laptop project) that was produced by a change on the independent variables. According to the regression analysis above, both teachers' perception and availability of digital subject content have insignificant effect on implementation of the project. The ICT skills possessed by primary school teachers and availability of facilities are leading with 2.980 and 0.352 deviations respectively. The researcher thus concluded that teachers' ICT skills and availability of facilities have significant impact on implementation of the laptop project in Kangundo Sub-County. The resulting regression model was:

$$Y = 0.150 + (-0.055X_1) + 2.980\ X_2 + 0.352\ X_3 + (1.67 \times 10^{-12}X_4)$$

Where: Y= Implementation of laptop projects, X_1= Teachers' perceptions, X_2= Teachers' Capability, X_3= Availability of facilities, and X_4= Digital subject content

In data analysis, the larger the R the stronger the relationship between the dependent variable and independent variables. R Square, the coefficient of determination, is the squared value of the multiple correlation coefficients. According to the results, more than 50% of the variation in the relationship is explained by the model. The value of R was 0.735 and R square was 0.540 (54.0%) as shown in the above table. Since the value of R square is more than 50%, the researcher deduced that the proportion of variation associated to the independent variables had effect on the dependent variable.

QUALITATIVE ANALYSIS

The MOEST official interviewed stated that the rollout of the laptop project by the government was a well thought idea. All schools were supplied with the laptops and teachers were trained on by the government, though further trainings to impart more ICT skills to teachers are necessary. According to the MOEST official interviewed, all schools in Kangundo Sub-County have been equipped with necessary facilities such as connection to power, storage rooms, desks and tables. However, there is need for provision of enough digital customized classrooms. According to the official, the supplied laptops were pre-installed with the required and appropriate digital subject content. However, there is need for KICD to review the digital subject content to integrate the new competency based curriculum for successful implementation of the laptop project in public primary schools.

CONCLUSION

The female respondents adopted in this study were many compared to male respondents. However, such variation in ratio was not preplanned but it occurred because most of the respondents were lower primary school teachers who are female in most cases. Most of these respondents (75.9%) were over 40 years, thus old in profession and with limited understanding

on IT related issues since it is a phenomenon that was introduced in teaching curriculum recently. All the respondents had mid-level education profile and with high perception on implementation of the laptop project.

Following the regression analysis outcome, availability of ICT facilities and teachers' capability on ICT have higher deviations on laptop project implementation. Therefore, it was concluded that availability of ICT related facilities, and teachers' capability on ICT had significant influence on laptop project implementation in Kangundo Sub-County. Also, considering that the R square value is above 50%, it was deduced that the rate of variation resulting from independent variables had significant effect on implementation of the project in this region.

RECOMMENDATIONS

1. The study shows that 68.6% of the teachers have high perception concerning the integration of ICT in the teaching process. However, 39% of the teachers feel that time allocated for integrating technology in classroom is not enough because they consume a lot of time in assembling the gadgets. Therefore, the researcher recommends that the government through KICD needs to review the time allocated per lesson to allow enough time for assembling and teaching. This will help in increasing perception of the laptop project among the lower primary school teachers in Kenya.
2. The study shows that 31.1% of the primary school teachers in Kangundo Sub-County find it difficult to assemble the ICT gadgets and 61.5% say that the acquired skills are not adequate. Therefore, the government, through appropriate departments needs to come up with modalities for equipping primary school teachers with skills that are tailored to the program.
3. According to the study, 52.5% of the schools in Kangundo Sub-County do not have customized ICT classrooms. Therefore, the government should come up with a plan for building standardized customized ICT classrooms and storage rooms for keeping the IT gadgets.
4. Considering that 68.2% of the head teachers believe that the digital subject content is inadequate, the government of Kenya through KICD needs to develop a comprehensive education curriculum that integrates technology and the new CBC in the teaching and learning processes.

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