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AN INVESTIGATION OF THE FACTORS INFLUENCING THE INTEGRATION OF ICT IN TEACHING AND LEARNING PROCESS IN PUBLIC SECONDARY SCHOOLS IN MACHAKOS COUNTY, KENYA

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Abstract

Information Communication Technologies (ICTs) plays a crucial role in all aspects of human life. Its effectiveness, efficiency and accuracy cannot go unnoticed. ICT has the potential to integrate world economies thus demolishing the barriers created by time and distance. Inspite of its role in improving service delivery, its integration in teaching and learning process in Kenya has been low and limited. This study reviewed a number of technology adoption models such as Theory of Planned Behaviour, Technology Acceptance Model, Unified Theory of Acceptance and Use of Technology and Diffusion of Innovation as well as educational theories namely behaviourism, cognitivism, and constructivism. The study adopted a descriptive research design approach and targeted public secondary schools in Machakos Sub-county.The findings show that ICT integration in the teaching and learning processes in secondary schools in Machakos Sub-county is still low. This has been influenced by a number of factors such as ICT competence among teachers, ICTs infrastructure as well as technical support. Interestingly ICTs infrastructure and technical support were not major determinants. The study also established that gender, age and experience also influenced the integration of ICTs in the teaching and learning processes. Lack of funds, poor training on ICTs usage among teachers as well as lack of incentives were some of the challenges identified in this study.The study recommends that teachers' readiness to integrate ICTs in teaching and learning process needs to be addressed

by availing funds that could be used to organize in-service training as well as acquire the necessary infrastructure. Teachers need to be offered incentives such as lower workload in order to embrace the use of ICTs in their lesson delivery. Further there is need to develop curricula that encourages the integration of ICTs rather than leaving the decision to the individual teacher. The government in addition can develop policy guidelines on the integration of ICTs in teaching and learning process.

Keywords: ICT integration, Teaching, Learning Process, Machakos County, Kenya

INTRODUCTION

Onunga's (1999) assertion that Information Communication Technology (ICT) has permeated all spheres of human life sixteen years ago is still relevant today because more than ever ICTs are being used in all economic sectors. Education been a key sector in the Kenyan economy has not been spared either. ICT provides an array of powerful tools that can help in transforming the present isolated, teacher-centered and text-bound classrooms into technology enriched, student-focused and interactive knowledge environments. (Anita R, Smriti M, 2013) A case in mind is e-learning which is increasingly gaining momentum in Kenya. (Omwenga et al, 2004).

The introduction of ICT and especially the internet has brought immerse changes in the world and more so in communication. Educational institutions are under increasing pressure to use the new information and communication technologies (ICTs) to teach students the knowledge and skills they need in the 21st century (Wan, 2011). ICTs have the potential to transform the nature of education: where and how learning takes place and the roles of students and teachers in the learning process.

Governments the world over have invested heavily on the provision of ICTs in public schools, the United Kingdom in the 2008/09 financial year budgeted 2.5 billion pounds while the USA used $ 6 billion in the same period for the provision of ICTs in education (Nut, 2010).

Kenya intends to use $ 600 million (Ksh. 53 billion) in the next three years to provide laptops to all pupils joining class one starting from January 2014. This is in addition to annual budgetary provision aimed at providing ICT facilities to educational institutions. The huge investment aims at creating knowledge based economy that will steer the country towards achieving Vision 2030. Apart from the provision of laptops to pupils, the government has also put in place measures that will equip teachers with the necessary skills for the successful implementation of the project.

Selwyn, (2007) points out that, despite these budgetary provisions, educational institutions may not achieve the intended goals. This study investigated the factors that may hinder the achievement of the goals in spite of measures taken by both the government and other stakeholders in encouraging the integration of ICTs in teaching and learning processes.

Today, there is a growing awareness among global policy makers and educators that the education system needs to be reformed if it is to effectively equip students with the knowledge, attitudes and skills that they will need to succeed and thrive in the knowledge society. Nowadays a shift towards integrated ICTs pedagogy which for the purpose of this study means the use of computers and computer-related technologies for educational purposes is being witnessed.

Kenya has not been left behind and towards this end it has developed an ICT policy that advocates for accessibility, equity and infrastructure development, with the aim of reducing the digital divide among the citizens (Ministry of Education, Science and Technology report, 2006). The challenge confronting our educational institutions is how to transform the curriculum and teaching-learning process to provide students with the skills to function effectively in this dynamic, information-rich, and continuously changing environment. To meet these challenges, learning institutions must embrace the new technologies and appropriate ICT tools for learning. They must also move towards the goal of transforming the traditional paradigm of teaching (Marshall, Kinuthia & Taylor, 2009).

As early as 1990s, secondary schools in Kenya increasingly acquired computers. Initially this was driven by pressure from education stakeholders such as parents, communities as well as politicians. Most of these computers came in form of donations and were basically used for administrative duties such as typing and printing of examinations, maintaining students' and fees records.

In 1996 Kenya Institute of Education (KIE) currently the Kenya Institute of Curriculum Development (KICD) developed the first computer studies syllabus for use in secondary schools. This made secondary schools acquire computers for teaching and learning purposes, however the huge resources required at the time made many schools to shy away from the subject.

Lately, the Kenyan government has made remarkable progress putting in place an ICT policy framework and implementation strategy complete with measurable outcomes and time frames. In 2006, National ICT policy was launched with the main objective of making Kenya an ICT hub and a premier location for Business Process Outsourcing (BPO) in Africa. This is a key step towards vision 2030 and attainment of Millennium Development Goals (MDGs). The process has had the benefit of sound advice from officials and stakeholders and, perhaps more

importantly, strong leadership from the then Ministry of Information and Communication. However, universal implementation is challenging given the lack of resources, national ICT infrastructure, and even electricity supply – particularly in the rural areas.

The private sector has not been left behind in encouraging schools to integrate ICT in the teaching and learning process. One such non-governmental organization is Computer for Schools Kenya (CFSK) whose mission is to provide Kenya's youth with access to modern technology through donation of computers to Kenyan public secondary schools (Reddick, 2010). Up to 2013 CFSK had sourced for 50,000 computers which were then distributed to about 3000 learning institutions. During the same period, Kenya School-net initiated a Trainer of Trainers training program with the aim of equipping personnel with skills and knowledge to facilitate learning of computers in Kenya.

Despite the efforts made by the government and the private sector, the question is, "are these computers being used to enhance teaching and learning in our secondary schools?" In the current curriculum, computer studies is a separate subject under Group Four of the subjects examined by Kenya National Examinations Council (KNEC) and therefore is optional. In the subject, learners are being taught how to be computer literate, and not how to use computers to enhance learning. The general trend is moving away from "teaching computer" toward using ICT as educational tools: integration of ICTs in the teaching and learning process (Muriithi, 2005).

Computer Programs have been developed to assist both the teacher and the learner to co-opt ICTs in the development and presentation of lessons in an interactive and user friendly manner. This has encouraged the integration of ICTs in teaching and learning processes.

Purpose of the Study

The main purpose of this study was to investigate the effects of corporate governance on the loan performance of commercial banks in Kenya.

THEORETICAL REVIEW

The purpose of this study is to investigate the factors influencing the integration of ICTs in teaching and learning processes in public secondary schools in Central Division Machakos Sub-county

Behaviourism

This theory was developed over the years by several psychologists including Ivan Pavlov, Edward Thorndike and B F Skinner among others. These researchers used animals to describe

and experiment that is parallel to human learning. Behaviorists believe that new knowledge can be acquired by operant conditioning where responses were learned from repeated stimuli and reinforced by rewards (Skinner, 1953). The learning process could be conceptualized as a series of small progressive steps leading up to a defined final performance. Bloom applied this theory to propose the Bloom's taxonomy that is used in testing learned behaviour todate (Eisner 2000). The idea of learning following a linear order was challenged by Buxkemper and Hartfiel (2003) they pointed out that learning is a complex process which does not follow a linear structure. Dewey's classic works suggest a student centred learning which led to the cognitive theory of learning. Despite the criticism leveled against this theory, it is imperative to note that it can be applied in ICTs adoption in teaching and learning process. Through this theory both teachers and learners can progressively learn the use of ICTs in the teaching and learning process. Each new learnt concept will form a basis and motivation for learning the next concept. Teachers will gain competence as they use ICTs in lesson delivery and students will look forward to the next lesson with anticipation to learn a new concept. Cumulatively both teacher and student will start to appreciate the benefits of ICTs in the teaching and learning process. This will lead to adoption of ICTs by both teachers and learners.

Cognitivism

This theory was advanced by Piaget in 1971, he describes cognitive development as a symbiosis between child's physical and mental interaction with the world and biological maturation of his or her nervous system. Cognitive science has changed the way educators view learning. Since the very early beginning of the Cognitive Revolution of the 1960s and 1970s, learning theory has undergone a great deal of change. Much of the empirical framework of Behaviorism was retained even though a new paradigm had begun. Cognitive theories look beyond behavior to explain brain-based learning. Cognitivists consider how human memory works to promote learning.

It is important to note that Computer Science and Information Technology have had a major influence on Cognitive Science theory. The Cognitive concepts of working memory (formerly known as short term memory) and long term memory have been facilitated by research and technology from the field of Computer Science. Today researchers are concentrating on topics like Cognitive load and Information Processing Theory. In addition, psychology as applied to media is easily measured in studying behavior. The area of media psychology is both cognitive and affective and is central to understanding educational technology.

This learning theory indicates that students learn from the known to unknown, this blends well with ICTs since once a concept is introduced students build on it to learn newer concepts. At first both teachers and students could be apprehensive of the adoption of ICTs in teaching and learning process, however as they build on the already acquired knowledge and learn new ones they become more confident in the use of ICTs. This eventually translates to the adoption of ICTs in the teaching and learning process.

Constructivism

Constructivism is a learning theory of educational philosophy that many educators began to consider in the 1990s. One of the primary tenets of this philosophy is that learners construct their own meaning from new information, as they interact with reality or others with different perspectives.

Constructivist learning environments require learners to use their prior knowledge and experiences to formulate new, related, and/or adaptive concepts in learning. Under this framework the role of the teacher becomes that of a facilitator, providing guidance so that learners can construct their own knowledge. Constructivist educators must make sure that the prior learning experiences are appropriate and related to the concepts being taught. Jonassen (1997) suggests "well-structured" learning environments are useful for novice learners and that "ill-structured" environments are only useful for more advanced learners. Educators utilizing technology when teaching with a constructivist perspective should choose technologies that reinforce prior learning perhaps in a problem-solving environment.

This study is based on the constructivist theory which will emphasize on cooperative and collaborative learning. In cooperative learning students work together to accomplish a learning task. This is achieved through division of labour among the participating students. It is a learner oriented approach to learning with the teacher giving general guidance (Baker, Blaye & O'Malley, 1996). ICT will give students a lee way to externalize their thinking, and allow them to put ideas into a more concrete form because of the available feedback.

On the other hand collaborative learning is a coordinated, synchronous activity that is the result of continued attempt to construct and maintain a shared conception of a problem (Rochelle & Teasley, 1995).

The adoption of ICTs in the teaching and learning process makes it possible for students to learn "on their own", the teacher gives general guidance on a concept and then supervises the students as they work together to build on prior knowledge to solve a problem. Learning becomes student centered giving them a lee way to explore different ways to solve a particular problem.

Once the student learn how to work together, teaching and learning becomes enjoyable both to the teacher and student. This encourages more teachers to adopt technology in order to enjoy these benefits.

EMPIRICAL LITERATURE

The use of ICTs in education is a complex process that requires immense resources. Most Kenyan schools lack the level of resources required for this process hence creating "barriers" (Schoepp, 2005) to the successful adoption of ICTs in the teaching and learning process.

Several researchers have studied these barriers and classified them as either individual, school, system barriers, extrinsic or intrinsic. Ertmer (1999) referred to extrinsic as first-order and cited access, time, support, resources and training and intrinsic as second order and cited attitudes, believes, practices and resistance; whereas, Hendren (2000) saw extrinsic barriers as pertaining to organizations rather than individuals and intrinsic barriers as pertaining to teachers, administrators and individuals.

Becta (2004) classifies the barriers as either teacher level or school level barriers. Teacher level barriers include lack of time, lack of confidence and resistance to change while school level barriers consists of lack of effective training in solving technical problems and lack of access to resources. Balanskat et al. (2006) divided the barriers into micro level barriers, including those related to teachers' attitudes and approach to ICT, meso level barriers, including those related to the institutional context. He also identified macro level barriers (system level barriers), including those related to the wider educational framework.

These studies classify the barriers at teacher, institution or system level. However, this study aims at investigating the factors that affect the use of ICTs in teaching and learning process at secondary schools in Central Division of Machakos Sub-County. It therefore focuses on the factors relating to the teacher and the selected schools.

Studies have shown that teachers' competence is a factor that influences ICTs use in teaching and learning. This refers to the knowledge and skills required to effectively use ICTs. Becta (2004) argued that teacher competence hinders the adoption of ICTs into pedagogical practice. If a teacher has the necessary skills, he/she will find it easy and enjoyable to employ technology in his/her teaching practice. However if one lacks these skills he will not be willing to embrace the use of technology in the teaching practice. It is important to note that this factor varies from one country to another and even regions (Pelgrum 2001, Al-Oteawi 2002).

Closely related to teachers' competence is teacher confidence (ability to use ICTs without fear of failure). Dawes (2001) sees this as a contextual factor which can act as a barrier.

According to Becta (2004), the issue of teacher confidence was the area that attracted most responses from participants in a survey on ICT practitioners.

Studies have shown that teachers who have limited ICT knowledge feel anxious about using ICT in classrooms (Balanskat et al, 2006, Becta, 2004, Cox, 1999). Such teachers will not use ICTs in their teaching since they fear making mistakes in front of their students who probably know more than they do. These studies concluded that lack of ICT confidence affects teachers' decision on whether or not to use ICTs in the teaching and learning processes.

Cox, Preston and Cox (1999) reported that teachers who are confident in the use of ICTs know their usefulness and immerse potential. Such teachers have no problem with adopting ICTs in their teaching/learning process. From the foregoing arguments it can be concluded that teachers' confidence in the use of ICTs influences their decision on whether or not to adopt ICTs.

Teachers attitude towards ICTs has also being cited as a factor that may determine whether or not a teacher uses ICTs in the teaching practice (Cox et al., 1999; Watson, 1999; Earle, 2002; Becta, 2004; Goomes, 2005). Teachers may form an attitude towards a certain technology due to age, gender, experience or even area of specialization. Digital divide exists between old and young teachers. Older teachers may find it difficult to embrace the use of technology in their teaching practice as they may argue that they have being teaching for long without technology. Young teachers on the other hand may enthusiastically use ICTs in their teaching/learning process therefore enhancing their lessons. Studies have also shown that female teachers are reluctant to use ICTs compared to their male counterparts due to lack of access, skill and interest (Volman & van Eck, 2001) in IJEDICT.

Teachers will find it difficult to change their way of doing things if they are not convinced about the usefulness of the change to them as individuals or to their students. It is therefore paramount to give information to teachers so as to enable them to make an informed decision on whether to adopt ICTs or not.

In addition to the factors that affect individual teachers there are those that are out of their control. The Kenya Government working hand in hand with the private sector has developed programs that equip teachers with the necessary knowledge and skills to enable them use ICTs in their teaching practice. Surprisingly not many of the teachers have adopted ICTs in their teaching practice. These teachers cite lack of time as the reason that they do not use ICTs in their lesson delivery (Al-Alwani, 2005; Becta, 2004; Beggs, 2000; Schoepp, 2005; Sicilia, 2005). Teachers have argued that their weekly load is too high to allow them time to prepare for technology lessons. Technology lessons require time to assemble the content as

well as visit several internet sites to consolidate information this makes the teachers to shy away from using ICTs in the teaching practice.

Apart from on the job training teachers go through as they prepare to use ICTs in the teaching practice, there are few if any training opportunities for teachers, (Pelgrum, 2001). The training opportunities available are for computer literacy and no meaningful training in ICTs use is available. This scenario makes it difficult for teachers to adopt ICTs in their teaching practice (Beggs, 2000). According to Becta (2004), the issue of training is complex because it brings together several aspects such as time for training, pedagogical training, skill training and ICT use in the initial teacher training. It is paramount to note that the initial teacher training should incorporate aspects of ICT pedagogical training so as to equip teachers with the necessary skills to enable them use ICTs in their teaching practice.

Inadequate resources in schools affect the adoption of ICTs in the teaching and learning process. Teachers complained about the frustrations they undergo when they tried to access computer facilities in their schools (Sicilia, 2005). The lack of access could be due to inadequate facilities or in some instances poor planning, making it difficult for both teachers and students to access the facilities (Becta, 2005). Resources such as internet connectivity and relevant educational software were not available in some cases; this made it difficult for teachers to effectively prepare for their lessons (Korte and Husing, 2007). However according to Balanskat et al, (2006) accessibility to ICT resources is not a guarantee that they will be successfully adopted in the teaching and learning process.

Despite the availability of ICT facilities teachers were unwilling to use them in teaching/learning process due to lack of technical support. Teachers have argued that there is no need to use ICT in classroom and end up spending most of the lesson in trouble shooting. Becta (2004) agreed that “if there is a lack of technical support available in a school, then it is likely that technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns”.

METHODOLOGY

Research Design

The study employed descriptive research design combining both qualitative and quantitative research methods. This study adopted a combination of sampling techniques that included; stratified, simple random and purposive techniques. Stratified technique was used to group public schools in Central division into three main strata namely; national, county and sub county schools. This classification was based on the Ministry of Education, Science and Technology guidelines where boarding schools are classified as County schools whereas day schools are

classified as Sub County schools. Simple random sampling technique was used to select the schools to be studied. In order to ensure that either gender was represented in the study purposive sampling was adopted.

For triangulation the researcher gathered quantitative data through administering survey questionnaire on the general student population and a semi structured questionnaire for teachers.

Study Location

The study was carried out in Central Division of Machakos Sub-County in Machakos County. Machakos Sub-County was selected purposively as the study site due to the rapport that exists between the researcher and most of the targeted respondents (head teachers and teachers). This made it easy to access the schools and gather the required data for the study.

Population of the Study

The target population comprised of head teachers, teachers and students in all secondary schools in Central Division of Machakos Sub-County. The head teachers are important in the study since they authorize expenses and make crucial decisions about infrastructure in their respective schools. Teachers are the implementers of the school curriculum and therefore play a big role in teaching and learning process. Students are the natural consumers of school policies and therefore may provide crucial feedback on teaching and learning process. The researcher hoped to gather information from the head teachers, teachers and students that could be used in investigating the factors that affect the use to ICTs in the teaching and learning process.

Sample of Study

Wiersma in Maleche (1997) defines a sample as a portion of the target population selected using some systematic procedures for study. There are 40 public secondary schools in Central Division. Twelve (12) schools were selected at random as shown in Table 1.

Table 1: Sampling Frame for the students

Category	Number of Schools	Sample Percentage	Schools in each category	Respondents from each school	Sample Size
National Schools	1	100%	1	30	30
County Schools	22	25%	6	18	108
S _County Schools	17	25%	5	18	90
Total	**40**		**12**		**228**

In order to select the number of teachers to participate in the study, the researcher established the total number of teachers in the selected schools which was found to be 113 teachers. Cochran formula was then used to determine the sample size for the teachers.

$$n = \frac{N}{1+N(\delta)^2}$$

n = sample size

N = Target population

δ = significance level

The number of teachers selected for the study at 5% level of significance was 88 based on the Cochran formula.

Sampling Design

For National school 15 students were selected at random from each class making a total of 30 students while for County and Sub-County schools 9 students were selected per class making a total of 18 students per school. More students were selected from the national school to reduce disparities for comparison purposes. Random sampling was used to select the teachers from each of the following subject areas; mathematics, languages, humanities, sciences and technical.

Inclusion and Exclusion Criteria

The survey population was drawn from forms 2 and 3 students. This is because the students have been long enough in the schools to know the extent to which teachers use ICTs in their respective subjects. Forms 1 and 4 students were excluded from the study because form 1 students have spent less than a term in the school and may not be well versed with the school system. Form 4 students are in their final year and busy preparing for their summative evaluation examinations.

Research Instruments

The study used survey questionnaires and semi structured questionnaires to collect data from the sampled subjects. The research questions comprised of rating scale, likert, and closed format types of questions.

Instrument Pre-test

The researcher conducted a pretest of the research instruments to establish their validity and reliability. The pretest was applied to a few identified subjects who could participate in the main study. The pretest subjects were briefed on their role, then the researcher allowed them to fill in the questionnaires. Any ambiguities in the questions were clarified to ensure that correct data was gathered. The researcher then corrected the questionnaires by removing the identified ambiguities.

Data Collection

When the validity and reliability of the research instruments was established, the researcher sought authority to conduct the research from the relevant authorities. Once granted the authority, the researcher sent an advance letter to the sampled schools explaining the purpose of the study.

All issues pertaining to the rights and responsibilities of the research subjects were explained and the confidentiality of the information gathered assured. The researcher administered the questionnaire to the sampled teachers while class teachers were requested to administer the students' questionnaires on behalf of the researcher.

The researcher gave sufficient instructions to the sampled respondents who then filled the questionnaire. The respondents were discouraged from discussing the research questions to reduce bias.

Students were allocated fifteen minutes to fill the questionnaires while teachers and head teachers were allocated thirty minutes. The researcher collected the filled questionnaires for subsequent data analysis.

Data Analysis Approach

The data collected was coded and checked for completeness. Frequency tables, percentages and graphs were used to present the research findings. The frequency tables showed the number of respondents in each of the required categories. The percentage of the respondents who choose a particular component was computed and comparison made among the categories. Statistical measures such as the mean, mode and standard deviation were also computed for comparison purposes. Finally the computed frequency, percentages and statistical measures were represented on tables and graphs for ease of interpretation. Statistical tool (SPSS) was used in the computation of the outlined measures.

EMPIRICAL FINDINGS

Cross tabulation

This section sought to establish how behavior intention to use ICT related to respondents' different attributes and characteristics.

Respondents who did not exhibit intention to use ICT behavior

The study developed a behavior intention to use ICT index through vigorous likert scaled questions to the respondents who were either found to have changed behavior towards ICT use or were rigid to ICT use. For the research analysis purposes those who had changed behavior were coded 1, otherwise they were coded 0. The Chi-Square test statistic was used to assess the significance of the findings. This was done by testing the independence of the paired observations (a behavior intention to use ICT and no behavior intention to use ICT) on the independent variables expressed in a contingency table. A Chi-square test was appropriate since the study design had a categorical data.

The value of the test-statistic is

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i}$$

Where:

χ^2= Pearson's cumulative test statistic, which asymptotically approaches a χ^2distribution

O_i= an observed frequency;

E_i= an expected (theoretical) frequency, asserted by the null hypothesis;

n= the number of cells in the table.

A decision is made after comparing the value of the test statistic to the critical value of χ^2_α with degree of freedom = (r - 1) (c - 1) where "r" and "c" are the number of rows and columns in a contingency table.

χ^2_t is the tabulated value of Chi-square . Level of significance (5%) for this study.

Table 2 shows a summary of the findings.

Table 2: Students' Behavior intention to use ICT

Behavior status	Frequency	Percentage
Behavior changed	75	36.1
Behavior not changed	133	63.8
Total	**208**	**100.0**

The study sought to find out the number of students who were integrating ICTs in their learning process. 75 students indicated that they were using ICTs in their study whereas 133 responded in the negative.

Table 3: Teachers' Behavior intention to use ICT

Behavior status	Frequency	Percentage
Behavior changed	29	42
Behavior not changed	40	58
Total	**69**	**100.0**

The study sought to find out the number of teachers who were integrating ICTs in their lesson delivery. 29 out of the 69 interviewed indicated that they used ICTs in their teaching and 40 responded in the negative. This shows that the integration of ICTs in secondary schools is still low.

Table 4: Behavior intention to use ICT and Respondents level of study

Behavior intention to use ICT		Class		Total
	Count	Form 2	Form 3	
0	**Observed**	28	48	**76**
	Expected	35.8	40.2	**76**
1	**Observed**	69	63	**132**
	Expected	61.2	70.8	**132**
Total		**97**	**111**	**208**

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} = \frac{(28-35.8)^2}{35.8} + \cdots + \frac{(63-70.8)^2}{70.8} = 5.07$$

The calculated chi-square value (5.07) was greater than the tabulated chi-square value (3.84) at 5% significance level with 1 degree of freedom. Therefore the respondent's level of study was statistically significant determinant of behavior intention to use ICT at 95% confidence level since $\chi^2_\alpha < \chi^2_t$ and P-value 0.024 < 0.05; Proportionally higher percentage 43.2% of the Form 3 students were receptive to behavior change compared to 28.9% of their Form 2 counterparts.

Table 5: Behavior intention to use ICT and the ICT infrastructure

Behavior intention to use ICT	Count	ICT infrastructure		Total
		No infrastructure	There is infrastructure	
0	**Observed**	46	30	**76**
	Expected	40.9	35.1	**76**
1	**Observed**	65	67	**132**
	Expected	70.1	61.9	**132**
Total		**111**	**97**	**208**

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} = \frac{(46-40.9)^2}{40.9} + \cdots + \frac{(67-61.9)^2}{61.9} = 2.17$$

The calculated chi-square value (2.17) was less than the tabulated chi-square value (3.84) at 5% significance level and 1 degree of freedom. Therefore the presence of ICT infrastructure was not statistically significant determinant of Behavior intention to use ICT at 95% confidence level since $\chi^2_\alpha < \chi^2_t$ and P-value 0.136 > 0.05; However more respondents 41.4% who had no ICT infrastructure had behavior intention to use ICT compared to 30.9% with the infrastructure.

The study found out that many teachers 15 out of 23 who were between 41 and 60 years of age did not exhibit intention to integrate ICTs in teaching and learning processes despite the presence of ICT facilities in their school. More teachers 31 out of 46 whose age ranged between 25 and 40 years indicated that they would consider integration of ICTs in their lesson delivery if ICT facilities were availed.

Table 6: Behavior intention to use ICT and Respondents' ICT use

Behavior intention to use ICT	Count	Teachers use ICT		Total
		Don't use	Use	
0	**Observed**	57	19	**76**
	Expected	46.7	29.3	**76**
1	**Observed**	72	60	**132**
	Expected	82.3	70.8	**132**
Total		**129**	**79**	**208**

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} = \frac{(57-46.7)^2}{46.7} + \cdots + \frac{(60-70.8)^2}{70.8} = 8.83$$

The calculated chi-square value (8.83) was greater than the tabulated chi-square value (3.84) at 5% significance and 1 degree of freedom. Therefore the level of ICT usage was statistically significant determinant of Behavior intention to use ICT at 95% confidence level since $\chi^2_\alpha < \chi^2_t$ and P-value 0.002 < 0.05; According to the study it was established that 55% of the respondents who were not using ICT did not have behavior intention to integrate ICT in teaching and learning process.

Table 7: Behavior intention to use ICT and Respondents' ICT competence

Behavior intention to use ICT	**Count**	**ICT Competence**		**Total**
		Competent	**Not Competent**	
0	**Observed**	36	40	**76**
	Expected	27.9	48.1	**76**
1	**Observed**	40	92	**132**
	Expected	48.1	83.9	**132**
Total		**76**	**132**	**208**

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} = \frac{(36-27.9)^2}{27.9} + \cdots + \frac{(92-83.9)^2}{83.9} = 5.86$$

The calculated chi-square value (5.86) was greater than the tabulated chi-square value (3.84). Therefore respondent's ICT competence was statistically significant determinant of behavior intention to use ICT at 95% confidence level since $\chi^2_\alpha < \chi^2_t$ and P-value 0.015 < 0.05; According to the study 53.3% of the competent teachers had their behavior intention to use ICT not changed compared to 70.2 % of those cited as not competent. Hence the teachers' competence is a key factor in determining the behavior change to use ICT in learning and teaching process.

The respondents' competence was in terms of their ability to process word documents, work with excel, work with data base packages like access, carry out power point presentation, operate a web browser and carry out some programming. The respondents expressed varied levels of ICT competence as summarized in Figure 1.

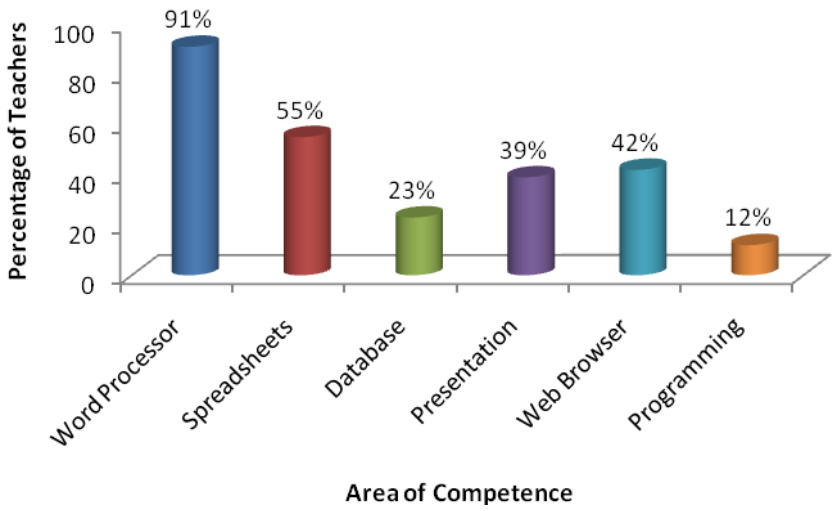

Figure 1. Teacher's Competence in ICT Packages

According to the study findings most of the respondents 62(91%) were highly competent in processing, editing and printing a word document. It was found that 38(55%) of the respondents were fairly competent in working on a spreadsheet. The most wanting area was programming by which only 8(12%) of the respondents were competent. Majority of the respondents 53(77%) were incompetent in working with database documents.

The study findings show that more male teachers 27(90%) were competent in the use of ICTs facilities than their female 23(58.9) counterparts. The study also found out that teachers whose age was below 30 years were more competent than those whose age was more than 30 years. All 23 teachers whose age was up to 30 years were competent in the use of ICTs. These were closely followed by teachers whose age was between 31 and 35 years 18 out of whom 15 indicated that they were competent. 5 teachers with ages more than 50 were interviewed and only 2 were competent in word processing.

Table 8: Behavior intention to use ICT and Respondents' technical support

Behavior intention to use ICT	**Count**	**Technical support**		**Total**
		No technical support	**There is technical support**	
0	**Observed**	24	52	**76**
	Expected	28.3	47.7	**76**
1	**Observed**	54	78	**132**
	Expected	49.7	70.8	**132**
Total		**78**	**130**	**208**

$$\chi^2 = \sum_{i=1}^{n} \frac{(O_i - E_i)^2}{E_i} = \frac{(24-28.3)^2}{28.3} + \cdots + \frac{(78-70.8)^2}{70.8} = 2.15$$

The calculated chi-square value (2.15) was less than the tabulated chi-square value (3.84) at 5% significance level. Therefore technical support was not statistically significant determinant of behavior intention to use ICT at 95% confidence level since $\chi^2_\alpha < \chi^2_t$ and P-value 0.204 > 0.05; However according to the study higher percentage 40% of those with technical support were more receptive to behavior change compared to 30.8% of those without the technical support. This implies technical support is still an influencing factor in determining the behavior change to use ICT in teaching and learning process.

In addition more female teachers 25(64.1%) were willing to integrate ICTs in the teaching and learning process if there was technical support. The study shows that 15(21.7%) teachers whose age was more than 40 years indicated that they would integrate ICTs in the teaching and learning process if there was technical support.

Regression Model Summary

Regression Analysis is concerned with the study of the dependence of one variable (*The Dependent Variable*), on one or more other variable(s) (*The Explanatory Variable*), with a view to estimating and or predicting the population parameters. Logistic regression was used to test the impacts of the students' level of study, ICT infrastructure, Teachers ICT use, Teachers ICT competence, and technical support on their behavior intention to use ICT in Machakos Sub-County, Machakos County, Kenya. The dependent variable being the dichotomous (binary) variable, of whether the respondent had intention to use ICT (1) or not (0), the central mathematical concept that underlies logistic regression is the logit-the natural logarithm of an odds ratio. Logistic regression describes the relationship between a dichotomous response variable and a set of explanatory variables. The explanatory variables may be continuous or discrete. Taking y as random variable that can take the values 1 and 0.

The simple logistic model has the form

$$logit(y) = Natural\ \log(odds) = (\frac{p}{1-p})$$

Such that

$$In\left(\frac{P}{1-P}\right) = l_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_n x_n$$

Where,

β_i denotes a vector of parameters,

X_i is the design matrix and

$X_i \beta_i$ is the linear component of the model.

The Model fitting test

This was done to test the appropriateness of using the logistic regression to predict the behavior intention to use ICT with the collected data. The findings are summarized in Table 9.

Table 9: Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	132.733a	0.484	0.664

The results in the Table suggested that between 48.4% to 66.4% of the variability in the dependent variable (behavior intention not to use ICT) could be explained by the given set of independent variables.

The Univariate Logistic Regression

The univariate logistic regression was done to test the association and significance of the predictor variables on the behavior intention to use ICT by picking one independent variable at a time while holding the rest constant. The findings are summarized in Table 10.

Table 10: Univariate logistic regression

Variable	Estimate	Std. Error	Z Value	OR(95%CI)	Pr(>|Z|)
Constant	2.147	0.599	3.90	-	0.005
Infrastructure	-0.659	0.517	-1.27	*0.52 (0.17,1.25)*	0.202
Teacher's ICT use	0.757	0.495	1.53	*2.13 (0.81, 5.62)*	0.126
ICT Competence	0.569	0.529	1.08	*1.77 (0.63, 4.98)*	1.081
Technical support	-0.067	0.469	-0.14	*0.935 (0.37, 2.34)*	-0.140

Although ICT use by teachers was not a significant factor at 95% confidence level in predicting the behavior change it was observed that teachers who did not use were 2.13 times worse in behavior change to use ICT compared to those who used ICT. The incompetent teachers were 77% more likely not to change their behavior to use ICT. Lack of technical support and

infrastructure were not significant in predicting behavior change to use ICT however their lack reduced the behavior change by 6.5% and 48% respectively.

The Results for Multivariate logistic regression

This was done by fitting all the predictor variables in the model at the same time and noting the impact of each on the independent variable in presence of one another. The findings are summarized in Table 11.

Table 11: Multivariate logistic regression

Variable	*(Intercept)*	Infrastructure	Teacher ICT use	ICT Competence	Technical support
Beta	2.147	-0.021	0.023	0.071	0.061

According to the results in Table 11 the likelihood of not changing behavior to adopt ICT in Machakos Sub-County, could be forecast by using the regression equation given as;

$$\frac{\exp\,(\propto + \beta x)}{1 + \exp\,(\propto + \beta x)} = 2.147 + -0.021(infrastruture) + 0.023(use\ ICT) + \cdots + 0.061(tech)$$

Whereby the value of betas or the coefficient of the predictors shows the magnitude of failure to change in ICT adoption in teaching and learning process (dependent variable) when the given regressor changes by a unit, according to the findings the ICT application had the highest impact (0.871) on the intention to change behavior on ICT use followed by the ICT teachers competence (0.071). The least in the equation was the infrastructure.

The challenges and constraints that influences the use of ICTs in teaching and learning process

The respondents were asked to state major challenges and constraints that influence the use of ICTs in teaching and learning process among secondary schools. The figure 2 summarizes the findings.

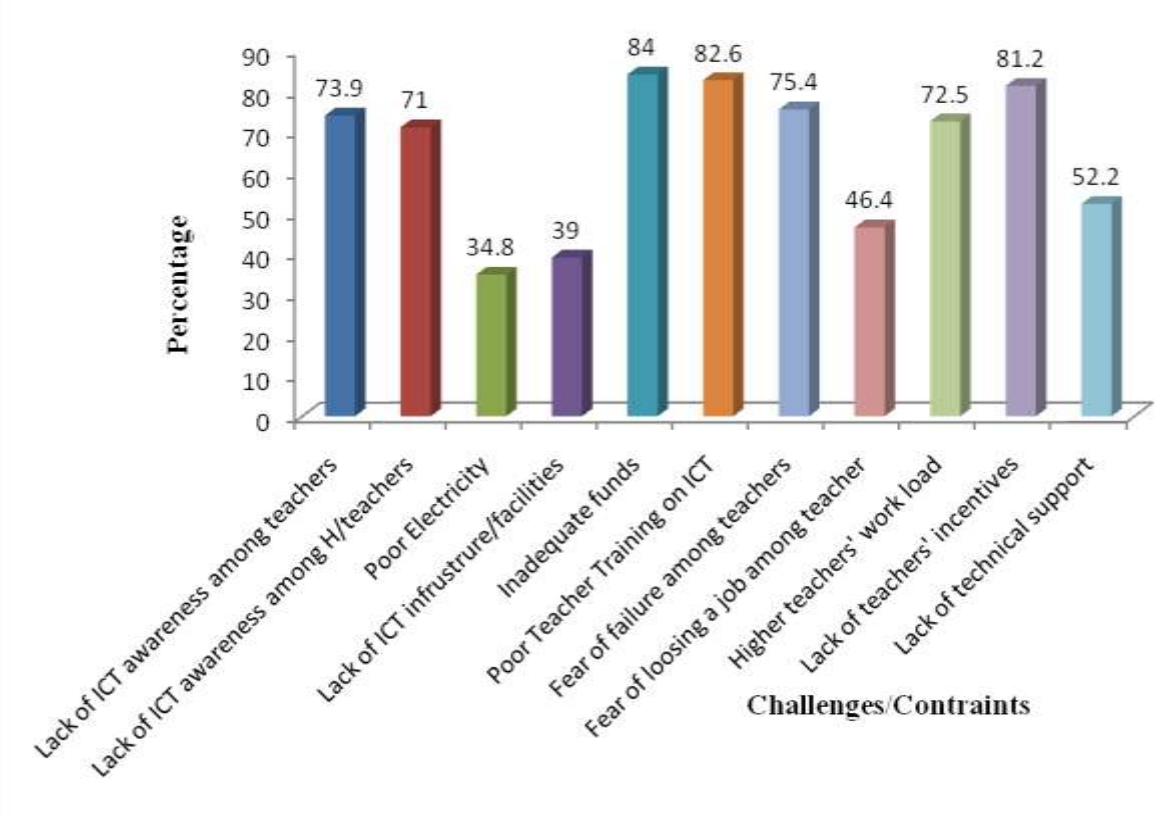

Figure 2. Challenges/Constraints

According to the research findings, the leading challenge was lack of funds at 58(84%). The next stated challenge was poor teacher training on ICT skills and knowledge at 57(82.6%) which was closely followed by lack of incentives among the teachers at 56(81.2%). The least cited challenge was poor electricity connectivity and supply at 24(34.8%) this could be due the study area's proximity to town. This was followed by fear of losing jobs by teachers at 32(46.4%). Among the least mentioned was also lack of technical support and lack of ICT infrastructure.

CONCLUSIONS

The aim of this study was to investigate the influence of; teacher competency, availability of facilities and technical support on the behavioural intention to integrate ICTs in teaching and learning process. The study also explored the challenges and constraints that influence the use of ICTs in teaching and learning process. The study showed that ICT application, ICT competence, infrastructure and technical support were major determinants of ICT integration in teaching and learning process. The Univariate logistic regression showed that teachers who used ICTs in their day to day activities were more likely to integrate ICTs in teaching and learning process. Based on the study findings teacher competency is a significant determinant

of behavioural intention to integrate ICTs in teaching and learning process. However, availability of ICT facilities and technical support were found not to be statistically significant determinants of ICTs integration in teaching and learning process. The leading challenge of ICTs use in the teaching and learning process was inadequate funds closely followed by lack of teachers' training on ICT and lack of teachers' incentives.

RECOMMENDATIONS

Information Communication Technology (ICT) has become a commonplace entity in all aspects of life. The use of ICT has fundamentally changed the practices and procedures of almost all forms of endeavour within business and governance institutions. Therefore ICT application in secondary school education cannot be overemphasized. The study recommends that in-service training of teachers on ICT skills be a continuous process to improve their competency. The study also recommends that female teachers be supported and encouraged to use ICTs in their lesson delivery. It was observed that the teachers who used ICT in their day to day activities were more receptive to behavioral change to integrate ICT in teaching and learning process. This study recommends that curriculum development and government policies be based on sound use of Information Communication Technologies in teaching and learning process so as to loop more teachers into the use of ICTs.

According to the research findings, the leading challenge was lack of funds at 58(84%). This study recommends more funds be allocated for teacher training on ICT use and acquiring of the necessary infrastructure. Many teachers 56(81.2%) cited lack of incentives as being one the challenges in ICT use for teaching and learning process. This study therefore recommends that the government through Teachers Service Commission (TSC) motivate teachers by employing more teachers so as to reduce workload hence creating more time for ICT lesson preparation.

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