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Effect of Teachers' ICT Pre-requisite Skills on Adoption and Use of Information Communication Technologies (ICT) in Public Secondary Schools in Kenya

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ABSTRACT: *The government of Kenya funded five secondary schools in every constituency in 2010/2011 financial year under ICT Economic Stimulus Programme (ESP).The move was geared towards catalyzing the adoption and use of ICT in secondary schools. The purpose of this study was to investigate the influence of teachers' ICT prerequisite skills on adoption and use of information communication technology (ICT) in public secondary schools in the republic of Kenya. The objective was to assess the effect of teachers' ICT pre-requisite skills on adoption and use of ICT. The study adopted a mixed methods research design, it was informed by the pragmatic philosophical paradigm and guided by diffusion of innovation (DOI) theory. The target population was 30,080 teachers from public secondary schools funded by the government of Kenya under ICT Economic Stimulus Programme (ESP). Participating regions, counties and schools were selected using simple random sampling design to obtain 384 teachers. ICT pre-requisite skills, was the independent variables while adoption and use of ICT in public secondary schools was the dependent variable. Data was collected by closed ended questionnaires and interview schedules. It was cleaned and presented using the mean, mode and range descriptive statistics. The hypothesis was tested via Pearson's Correlation Coefficient. The study established a statistically significant relationship between teachers' pre-requisite ICT skills and adoption and use of ICT of + 0.154. The study recommended a follow up/monitoring and evaluation of adoption and use of ICT on termly basis until it picks the momentum, a review of the teacher education curriculum to reflect more courses in ICT, emphasis on in-service training in ICT. Finding and recommendation of this study will be of use to education stakeholders; policy makers, teachers, students and the government as they strives to attain* vision *2030.*
KEY WORDS: *Adoption, Effect, Information Communication Technology, Skills, teachers.*

I. INTRODUCTION

According to Tinio (2002), as the half-life of information continued to shrink and access of information continued to grow exponentially, schools could not remain mere venues of transmission of a prescribed set of information from teachers to students over a fixed period of time, but to provide the acquisition of knowledge and skills that make possible continuous learning over a lifetime.Steyn and Johnson (2011) assert that ICT is usually anecdotally linked to improvements in the quality of classroom instruction and general improvement of the quality of education, but acknowledge that there is an absence of rigorous research to support these claims. Kulik (1994) in the meta-analysis study established that on average students who used ICT based instruction scored higher than students without computers. They learned more in less time and liked their classes more when ICT based instructions were included. Sossin*et al.* (2004) constructed a data base of 67 sections of introductory enrolling 3,986 students taught by 30 instructors across 15 institutions in the United States of America. They found significant but small positive impact on student performance due to ICT use. Further some ICT materials seemed to be positively correlated to the performance while others were not.

According to Marah, (2010) in an article on the integration of ICT in India, countries that were spearheading the use of ICT in education were the UK, Australia and USA. India and other countries were yet to realize that change was upon them. However, the experience of introducing ICT in the classroom and other educational settings all over the world showed that the full realization of the benefits of ICT was not automatic (Tinio, 2002). Rather the effective integration of ICT in education was a complex and multifaceted process that involves not only technology, but also; curriculum and pedagogy, institutional readiness, teacher competence as well as long term financing.

A study on ICT integration in schools in Nepal identified the following as some of the challenges of the process: lack of access to electricity, majority of the teachers were information-illiterate and the school level curricular was not updated to embrace the use of ICT in the classroom (Hennessy, Harrison &Wamakote 2010). However it was noted that although the lack of access was a challenge, its availability did not translate into use because other educational factors also have roles to play.

ICT was ubiquitous in Asia's high income and developed countries. However, in many of its developing countries the integration and use of ICT was low-cut, especially the more advanced forms of ICT and broadband connectivity in economic spheres, communications, employment and commerce inclusive. As a consequence, children and youth in these countries frequently learnt more about how to use ICT informally outside the school system than in a classroom (Wallet and Melgar, 2014).

Janssens-Bevernage, Cornnile&Mwaniki, (2002) noted a common misconception that access to technology on its own could motivate teachers to apply it in their teaching. This was not the case since ICTs in education were not transformative on their own, but required teachers who could use technology to improve student learning. Petrogiannis, (2010) carried out a study on perceived preparedness for computer use and other psychological constructs among kindergarten teachers with and without computer experience, in the prospect of ICT integration in pre- school classes following a new curriculum in Greece. The finding of the study revealed significant differences between those who had at least a minimum level of computer-use experience and those without. Inexperienced teachers perceived themselves as unprepared for the development.

The idea of adoption and use of Information Communication Technology (ICT) in Kenya is not a new development. With the introduction of computers in the country in the 1970s and later the internet in 1993, great effort has been made to adopt and use ICT in education (Ford 2007). The Kenyan Government, through its key ministries of Education, Science and Technology and Information and Communication Technology, has developed several policy and strategy documents to guide the integration of ICT in education (National ICT Policy, 2006; Sessional Paper No. 1 of 2005 and Kenya Education Sector Support Programme, 2005-2010). The move by the Government of Kenya (GOK) to fund five secondary schools in every constituency in 2010/2011 financial year was geared towards catalyzing the adoption and use of ICT in secondary schools (Temba, 2012). Additionally the Kenya government had the initiative of launching the Laptop Project at standard one level in all public primary schools as proposed in the year 2013.

Despite the efforts and multi-investment by the government and other stakeholders, the level of consumption of ICT seemed to be lacking in synergy and its adoption and use remained significantly low. According to Manduku, Kosgey& Sang (2012) the education sector was investing heavily in ICT but the technology adoption and use continued lagging behind other sectors. Similarly a study by Mbithi (2014) on integration of ICT in Instruction of English, in Secondary schools in Matungulu district of Machakos county of Kenya indicated limited use. Murithi and Indoshe (2014) also found that adoption of ICT was lukewarm despite the existence of a positive attitude by both the teachers and student in secondary schools in North Imenti District of Kenya.

Majority of the studies on integration of ICT in education have mainly focused on lack of infrastructure either hardware or software. Other studies have looked at physical and cultural factors influencing integration of ICT in education. There is very little information on the effect of teachers' ICT pre-requisite skills on the adoption and use of ICT in educational institutions in Kenya after the ICT ESP programme was introduced in Public secondary schools in Kenya. It was for these reasons that this study was carried to establish the effect of teachers' ICT pre-requisite skills on adoption and use of ICT in public secondary schools.

II. Research Design and Methodology

2.1 Philosophical Underpinnings

According to Cresswell (2009), Philosophical underpinning also called philosophical world view refers to a basic set of beliefs that guide action. There exist four world views about the world and the nature of research held by the researcher namely; Postpositivism, Constructivism, Advocacy/Participatory and Pragmatism (Cherryholmes, 1992)

Pragmatic world view directed this study. This world view arises out of actions, situations and consequences. It is concerned with applications and solutions to problems. It is seen in mixed methods type of research design (Cherryholmes, 1992; Cresswell, 2009). The researcher emphasizes the research and uses all the approaches available to understand the problem.The inquirers draw liberally from both quantitative and qualitative assumption which they engage in their research. This study was warranted by the existing situation and status of ICT adoption, in the wake of the multibillion ICT investments in the education sector. The quest to further understand the problem, the effect of independent variable; teachers' ICT pre-requisite skills, on the dependent variable; adoption and use of ICT in Public secondary schools was investigated which was the rationale for this study.

2.2 Research Design

Research design is a plan and procedure to conduct research; it involves intersection of philosophy, strategies of inquiry and specific methods/instrumentation (Creswell, 2009: Wiersma, 2000). This study adopted a mixed methods research design that leans towards quantitative research. Quantitative research according to Creswell (2009), is a means for testing objective theories by examining the relationships among variables, the variables in turn can be measured typically on instruments so that numbered data can be analyzed using statistical procedures.

The mixed methods research design involved the intersection of the pragmatic world view, survey strategy to inquiry and questionnaire and interview schedule methods of data collection. This study purported to establish the effect of teachers' ICT prerequisite skills on adoption and use of ICT in public secondary schools. The research design used for this study can be summarized as in figure 1 below

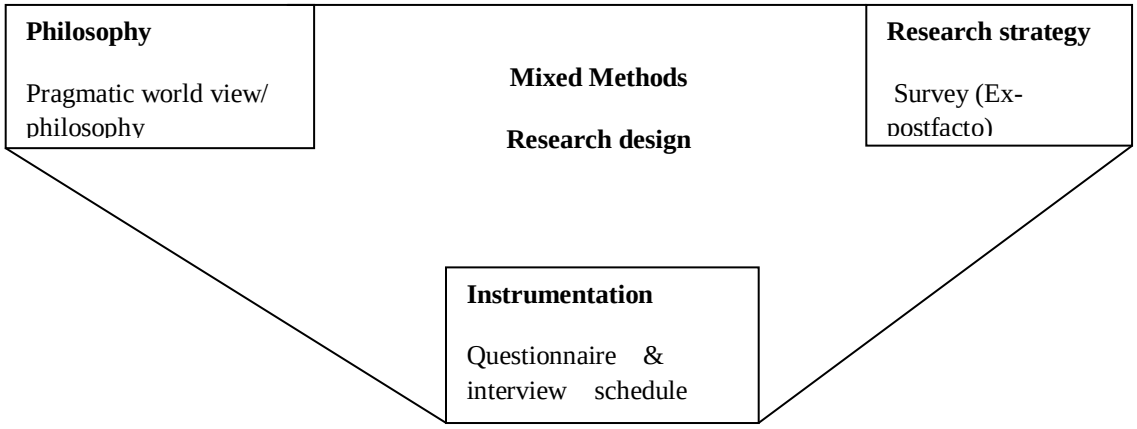

Figure 1: Research Design

The survey research strategy of inquiry was deemed appropriate because it provides a quantitative description of trends, attitudes or opinions of populations by studying a sample of the population. Strength of survey research is possibility to gather information from a large sample of people which is generally seen as a good method to employ if the aim of the study is to acquire information about people's attitudes, beliefs and behaviour (Michell& Jolly, 1996) The study was cross-sectional and the questionnaire and interview was administered to the selected sample. The results obtained can therefore be generalized to the population under study.

2.3 Area of Study

The study was carried out in the Republic of Kenya across its 47 counties. Previously Kenya had been subdivided into provinces which ceased with the promulgation of the new constitution in the year 2010. These provinces were replaced by subdivisions called regions as per the ministry of education. A region is made up of a number of counties ranging from three to eight in number. There were eight regions namely: Metropolitan which consisted of Nairobi county, Machakos county, Makueni county and Kajiado county; Aberdares region consisted of Kiambu, county, Kirinyaga county, Murang'a county, Nyeri county, Nyandarwa and laikipia county; Highland region consisted of Marsabit county, Isiolo county, Meru county, Tharakanithi county, Embu county, Kitui county and Samburu counties; Mau region was composed of Nakuru county, Narok county, Kericho county Bomet county, Baringo county, Elgeyomarakwet county, Uasin- Gishu county and Nandi county; Nzoia region had the following counties, Kakamega , Busia, Vihiga, Bungoma, Trans Nzoia, West Pokot and Turkana counties; The lake region consisted of Kisumu county, Siaya county Homa Bay, Migori, kisii and Nyamira county; Coast region comprised of Mombasa, Kwale, Kilifi, Lamu, Tana River and TaitaTaveta ; The eighth region is the Northern region which consists of Garissa , Wajir and Mandera counties. Each of these counties had secondary schools that were funded by the Ministry of Education in the Economic Stimulus Programme (E S P) for adoption and use of ICT in education. The findings would therefore apply to all secondary schools in the country and to other countries having similar characteristics.

2.4 Target Population

Target population refers to the entire group of individuals or objects to which researchers are interested in generalizing the conclusions. It usually has varying characteristics and it is also known as theoretical population (Crotty, 1998; Creswell, 2009).This study dealt with secondary school teachers in the schools that were funded by the government of Kenya for adoption and use of ICT in the famous ESP programme. The ESP targeted each constituency funding 5 schools in each constituency. At least 20 Secondary schools in each of the 47 counties were funded by the Ministry of Education to enable the integration of ICT in secondary education and hence a

total of 940 secondary schools (20 x 47) was the sample frame. Given that the average number of teachers per school is 32, target population was 30,080 secondary school teachers (32 x 940).

Accessible population is the population in research in which researchers can apply their conclusions. It is a subset of the target population and it is also known as the study population. Study population is the actual sampling frame from which the researcher randomly draws the sample (Crotty 1998; Gay &Diehi 1992; Gay 2002). The study population was obtained for the two regions (Mau and the Lake regions) from each of which two counties were selected. Twenty schools from each county had been funded during the ESP. On average each school having 32 teachers , hence accessible population of 2560 teachers: (2x2x20x32).

2.5 Sample Design and Procedure

According to Gay (2002), stating the sample size and sampling procedure enables the establishment of a representative sample for generalization. To obtain the study sample for correlational research 30 cases or more are required, for descriptive studies 10% of the accessible population is enough while for experimental studies at least 30 cases are required per group (Mugenda&Mugenda 1999;Gay 2002).

A number of secondary schools were funded by the government in the Economic Stimulus Programme (ESP) to integrate ICT in education during 2010/ 2011 financial year. Teachers in these schools constituted the target population as obtained earlier which was 30,080 teachers. According to Krejcie& Morgan (1970), the sample size for a finite population can be obtained from a table. Consequently for the target population of 30,080 the sample size would be 379 teachers. However the researcher opted for a sample of 384 to allow for any loss or uncompleted questionnaire. According to Gay &Diehi (1992), large sample sizes enhance the likelihood of yielding statistically significant results and the rule of thumb is to obtain as big sample as possible. Krejcie& Morgan (1970) assert that as the population increases the sample size increase at a diminishing rate (plateau) and remains eventually constant at slightly above 380 cases. They state that there is little to be gained to warrant the expense and the energy to sample beyond 380 cases.

Given the country's eight regional sub divisions proposed by the ministry of education (Appendix B). The following regions existed; Metropolitan, Aberdares, Highlands, Mau, Nzoia, Lake, Coastal and Northern. Simple random sampling was done on the regions with Northern region being left out for security reasons. Based on the rule of thumb (30%), two regions; Mau and lake regions were selected out of the 7 regions. The rule was further applied to select two counties from each of the two regions having eight and six counties respectively. These were Bomet County, Uasin-Gishu County from Mau region while Homa Bay and Kisumu County of the Lake region were selected for the study. Stratified random sampling was further used to pick 6 schools from each of the four counties leading to 24 schools. Similarly, sixteen teachers were randomly selected from each of these schools giving a sample of 384 teachers. The following departments exist in schools and formed the strata; Languages, Humanities, Science, Mathematics and Technical and Applied Sciences. The 384 teachers were subjected to secondary school teachers' questionnaire with representation from each department. The chosen sample would be at the 95% confidence level with a margin error of 5%. Table 1 below shows how the sample was obtained.

Table 1: Sampling Procedure

	Number of teachers	Number of schools from counties	Total number of teachers(sample)
Mathematics	4	24	96
Science	4	24	96
Languages	3	24	72
Humanities	3	24	72
Technical and Creative Arts	2	24	48
Total	16		384

2.6Data Collection Instruments

Data was collected using closed ended questionnaire and interview schedule. The researcher delivered most of the questionnaires personally and waited for response or would return to collect the feedback on a date agreed on. Other questionnaires were mailed through post or courier services and either mailed back or collected physically by the researcher. For most of the schools where the researcher went to, the senior teacher or one in a similar capacity was interviewed. This method of data collection was appropriate for the survey research strategy because the population under study was large. It was also economical and fast.

2.7 Development of the instruments

Data collection instruments were developed by modifying an instrument tagged teachers ICT use survey, adopted from ICT survey indicator for teachers and staff by UNESCO (2004). The instruments were standardized and successfully used to collect data on studies on ICT and found to have been reliable and valid

(Laaria, 2013). The decision was arrived at after discussion and consultation with members of Education Management and Policy Studies department of Moi University. Section I of the questionnaire was devoted to addressing ethical issues; thus a brief introduction of the researcher's purpose of the study and a guarantee that collected data would be treated with utmost confidentiality. These according to MC Millan & Schumacher (2010) are vital considerations in research involving human subjects. The 2nd section was meant to capture demographic data; Gender, Department,, Teaching Experience, and Age in years of the respondents .Section 3 of the questionnaire was to get data on adequacy of ICT training while section 4 sought information on ICT adoption and use in Schools. Section 5 and 6 had to collect information on challenges affecting adoption and teachers perception of adoption of ICT in schools respectively. Sections 3, 4 , 5 and 6 had questions on a Likert scale of 1 to 5 where 1- meant Strongly Disagree, 2- Disagree, 3- Undecided , 4- Agree and 5 Strongly Agree.

2.8 Validity of Instruments.

Validity refers to the extent by which an instrument measures what it is supposed to measure (Wiersma, 2000; Mugenda&Mugenda, 1999). It entails establishing whether an instrument measures the characteristic trait or whatever for which it was intended. There are three types of validity; content related validity, Criterion related validity and Construct related validity. Construct validity is an overarching encompassing other validity. It was observed by running factor analysis on the items testing teachers ICT pre-requisite skills. Content validation on the other hand is a logical analysis of the items to determine their representativeness; it refers to the extent to which a measure represents all facets of a given social construct. It is essentially a judgment analysis. To ascertain Content validity of this study's test items; the questionnaire and the interview schedule were presented to a panel of specialists in the field of education and research Moi University Eldoret, Kenya. This was purposed to scrutinize and analyze these tools to ensure that the objectives of the study would be realized through them. For instance during the scrutiny item 10, 11 and13 in section 5 of the questionnaire were negatively worded and the advice was to ensure they be made positive or they be reverse coded during the analysis. The interview schedule was also direction oriented. The resolution was that it be made open to enable the respondents give their views widely without restrictions.

2.9 Reliability of Instruments

Test reliability refers to consistency of measurement, the extent to which the scores are similar over different forms of the same instrument or occasions of data collection. The goal of developing reliable measures is to minimize the influence on the scores of chance or other variables unrelated to the intent of the measure (Mc Millan and Schumacher, 2001; Creswell, 2009). According to Wiersma (2000), in a conceptual sense, an observed score can be seen as consisting of two parts; one part the individual's true score and the other part an error score, which is due to the inaccuracy of measurement. If there is little error in the scores, the reliability is high.

There are four test types of reliability; internal test consistency, test retest, parallel form and test equivalence or stability (Mc Millan and Schumacher, 2001). For this study internal reliability of test items was determined by Split half after a pilot study done in secondary schools in the Nzoia region of Kenya which was not among the sampled regions. The items were sub-divided into two based on odd and even numbered items. The scores on the two halves were correlated using Pearson's Correlation which gave a coefficient of + 0.846 implying that the data was highly reliable. The Split half technique was chosen because it eliminates the chance of error due to differing conditions as would arise if test re-test was used.

2.10 Administration of the Instruments

The researcher embarked on data collection in March and early April 2016.The tools of data collection were delivered personally to three counties; UasinGishu, Bomet and Kisumu county . It was mailed to a research assistant in Homa Bay County who also delivered them personally. In most cases the questionnaire and the interview were administered and returned on the same day. However in a few schools an agreement was struck and they would be collected in a day's time or two.

2.11 Data Analysis

Data obtained from the questionnaire and interviews was cleaned and presented in frequency distribution tables. The Statistical Package for Social Scientists (SPSS) version 20.0 was used in the analysis. The following descriptive statistics were obtained; the mean, mode and percentages while standard deviation and variance were used to establish variability in response obtained. The hypothesis was tested by Pearson's correlation coefficient as shown by table 2 below

Table.2: Data Analysis

Variable	Statistical Test
Demographic Information	Descriptive statistic, percentages , Mean and mode
ICT pre- requisite skills	Descriptive statistics, Percentages mean , mode and

	factor analysis
Adoption and use of ICT	Descriptive statistics, Percentages and factor analysis
Hypothesis H_{o1}	Pearson's correlation coefficient
Modelling	Linear regression analysis

Regression analysis also called modelling is the development of a mathematical expression that describe in some sense, the behaviour of a random variable of interest called the dependent variable Y. It describes how the mean of the dependent variable changes with changing condition (Pantula& Dickey, 1998). Other variables thought to provide information on the behaviour of the dependent variable are incorporated into the model and denoted by X. The function relationship between the mean of variable Y and X is the equation of a straight line

$Y_i = B_o + B_1X_i + e_i$

When the model uses more than one independent variable to explain the behaviour of the dependent variable the equation becomes `

$Y_i = B_o + B_1X_i + B_2X_{i2} + \ldots\ldots\ldots + B_pX_{ip} + e_i$

Where $e_i$is the random error due to deviation of an observed Yi from its population mean (Pantula& Dickey 1998).

III. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

3.1 Introduction

The purpose of this study was to determine the effect of teachers' ICT pre-requisite skills on adoption and use of ICT in public secondary schools in Kenya. Data was collected to enable attainment of the objective;

1. Assessing the effect of ICT pre-requisite skills of teachers on adoption and use of ICT in public secondary schools.

Respondents were teachers from public secondary schools that benefited from ICT Economic Stimulus Program in Kenya in 2010/2011 financial year. This was to act as a catalyst to effect ICT integration in education under the Ministry of Education (MOE). During the 2010/2011 financial year, money was allocated to five schools in every constituency in the whole republic of Kenya under phase 1.

3.2 Response Rate

Response rate refers to the percentage of respondents returning the questionnaire and the quality of response depends on the completeness of the data (Wiersma, 2000). One of the persistent problems with questionnaire studies has been the possibility of a high rate of non-response which affects the validity of the survey. Writers according to Wiersma (2000) have differed on suggested minimum response rate. However he suggests that when surveying professional population 70% is considered the minimum but for the general public more non-response can be tolerated.

A total of 384 questionnaires had been administered to teachers using either of the ways discussed earlier. Out of these 36 declined to respond for various reasons the major one being very busy schedules while 18 had missing responses. Only 252 questionnaires were duly filled giving a response rate of 65.6%. The rest, 78 questionnaires could not be retrieved either due to mailing challenges or were lost as shown in Table 3 below.

Table 3: Questionnaire Response Rate

Total # of Questionnaires distributed	Questionnaires not filled	Incomplete questionnaires	Lost Questionnaires	Duly filled Questionnaires	Total Response
384	36	18	78	252	252 (65.6%)

The responses from 252 questionnaires duly filled were analyzed.

3.3 Data Screening

Data screening is critical to protect the integrity of inferential statistics (Tabachnick&Fidell, 2007). It involves careful consideration and necessary resolutions of any issues before the main analysis of data to ascertain honest analysis of data. Data screening checks for erroneous data entry, missing data, detecting and making decisions about univariate outliers, screening for and making decisions about univariate assumptions.

3.4 Detecting Erroneous Data Entry.
Integrity of the researcher's data can be significantly compromised by entering wrong data. In this study the researcher dealt with this issue by keenly entering data personally and kept comparing the original data to that in the data view and making corrections immediately.

3.5 Identifying and Dealing with Missing Data.
Missing values occur when respondents fail to respond to some items or sections of items. Missing values involved only 18 cases out of 384 cases (5%) and were deleted case wise. According to Stevens (2002), if missing data is less than 5% then it is considered less serious can be dealt with by deleting case wise. When missing data is above 5% other methods can be used which include: Estimating (imputing) by prior knowledge and replacing the missing value with a value reflecting the researcher's judgment; Mean substitution; Regression; Expectation maximization and Multiple imputations.

3.6 Detecting and Making Decisions about Univariate Outliers
Results of statistical analysis should reflect most of the data and not be highly influenced by just one or two errant data points (Stevens, 2002). In such cases then results will not generalize except to another sample with similar outliers. Outliers would arise due to; incorrect data entry: failure to specify missing values in computer syntax and hence read as real data: outlier is not a member of the population that you intended to sample: outlier is a representative of the population you intended to sample but the population had extreme scores than a normal distribution. Outliers according to Jaccard&Turrisi (2003), have negative effect on the regression equation. They can change the SPSS statistic output and reduce the accuracy of your result as well as the final statistical significance. According to Tabachnick& Fidel (2007), univariate outliers for continuous variables are those whose Z scores are in excess of absolute 3.29 ($p<0.001$) two tailed test.
To check and detect the presence of outliers in this study all the scores were standardized to obtain their z-scores and eight cases were considered outliers because they had absolute Z-scores values above 3.29. They were deleted case wise leaving 244 cases for further analysis.

3.7 Screening for and Making Decisions about Univariate Assumptions
Many statistical analyses including regression require that all groups come from normal populations (Norusis, 1994a).Test for normality involves an assessment of histograms, normal Quartile-Quartile (Q-Q) plots, skewness, kurtosis and the Shapiro-Wilks' statistics. Histograms give a general visual description of the distribution of data values. Through visual interpretation of histograms the data was found to be symmetrical (Mesokurtic) with all cases clustered around a central value an indication of normality.

In normal probability plots each observed value is paired with its expected value from the normal distribution. Analysis of the Q-Q plots for this study showed the points clustered around a horizontal line through the origin without any striking pattern. This was a strong indication that data was normal (Norusis, 1994b).

The data for this study was also checked for skewness. Skewness is the measure of symmetry of a distribution while kurtosis is used to measure the peakness or flatness of a distribution (Tabachnic&Fidell, 2013). Based on the results the values for skewness and kurtosis revealed that the data was normally distributed. The skewness of data on ICT pre-requisite skills of teachers on adoption and use of ICT was 0.039 with standard error of 0.222. As a result normality of the data was indicated. Dividing the skeweness by the standard error gave + 0.1756 which is less than 3.29 ($p<0.001$), which according to Tabachnick&Fidell (2003) meant there was no significant departure from normality.

3.8 Descriptive Analyses
Descriptive statistics were analyzed in terms of frequencies and percentages for respondents' background information and the variables; teachers' ICT pre-requisite skills on adoption and use of ICT.

3.9 Background Information and Characteristic of the Sample
The study sample consisted of 244 public secondary school teachers out of whom 162 were male and 82 were female. Male teachers were more than female teachers in public secondary schools as depicted by information in Table 4 below. The male teachers were 66.4 % while female teachers were 33.6 %.

Table 4: Gender of Respondents

Gender	Frequency	%
Male	162	66.4
Female	82	33.6
Total	244	100

The respondents were teachers obtained from all the departments in the sample schools as indicated by Table 5 below.

Table 5: Departments of Respondents

Department of respondents	Frequency	Percent
Languages	71	29.1
Mathematics	41	16.8
Sciences	55	22.5
Humanities	45	18.4
Technical and applied Sciences	32	13.1
Total	244	100

The languages and science departments seem to have had a larger number of respondents than the others. However, this is because the two departments normally have more teachers as dictated by the number of lessons for languages and more subjects in the science department hence, it was proportional to the teachers in the respective departments.

The responses cut across all the ages of the teachers as shown by Table 6 below. Majority of the teachers fell in the age bracket of 25 – 30 years. While other age brackets had fewer number of teachers.

Table 6: Age of Respondents and Teaching Experience in Years

Age of Respondents in Years	Frequency	Percent	Teaching Experience in Years	Frequency	Percent
18- 24yrs	30	12.3	1-5	128	52.5
25- 30yrs	100	41.0	6-10	59	24.2
31-40yrs	78	32.0	11-20	45	18.4
Above 40yrs	36	14.8	Above 20	12	4.9
Total	244	100.0	Total	244	100

The age bracket was normally distributed. Teachers within age bracket of 18-24 years constituted 12.3% and 25-40 years was 41 %. However the teaching experience was positively skewed. This could be attributed to employment of teachers that has been taking place on yearly basis by the Teachers Service Commission and the employment by the Board of Management to resolve the acute teacher shortage in secondary schools. These findings are similar to those by Haji (2015) in secondary schools in Cameroon where the schools had a younger teaching force as almost 50% were below age 40 years. Finding of this study established that these young teachers were not in their respective schools during teacher training in ICT by ICT champions in preparation for the implementation of ICT, ESP programme. However, most of these young teachers had vast knowledge in ICT though not sure of how and when to use it in their teaching activities.

3.10 Teachers ICT Pre-requisite Skills

Teachers responded to an item in the questionnaires to establish if they had proficiency in the following ICT skills: word processing, data processing, spread sheets, power point, internet and e-mail. They responded to a Likert scale of 1 to 5 whereby ; SD- strongly disagree had a value 1, D-disagree with value 2, U – Undecided with value 3, A-Agree with value 4 and SA- strongly agree with value 5. The teachers mean responses on their possession of the skills was obtained as in table 7 below

` Table 7:Teachers' ICT Pre-requisite Skills

Skill	Frequency (f)	Percentage (%)	Mean Response	Minimum	Maximum
Word Processing	219	89.8%	4.3	1.0	5.0
Data Processing	178	73%	3.8	1.0	5.0
Spreadsheets	167	68.5	3.7	1.0	5.0
Power point	190	77.8	4.0	1.0	5.0
Internet	220	90.1	4.3	1.0	5.0
e-mail	221	90.6	4.3	1.0	5.0

From the table the skills in data processing, Spread sheets and power point had mean responses of 3.8, 3.7 and 4.0 respectively .The mean response of value 3.00 indicates uncertainty or indecisiveness about the ICT skills possessed. The value 3.00 on the Likert scale meant they were undecided while 4.00 stood for agreeing to possess the skill .Thus as per their response, 73% had proficiency in data processing, 68.5% in spread sheets and 77.8% in PowerPoint. The mean response of their proficiency in word processing was 4.3(89.8%), use of the internet was 4.3 (90.1%) and e-mail had a mean response of 4.3(90.6%). Some teachers lacked the necessary ICT skills for adoption and use of ICT in public secondary schools. These findings were in agreement with GOK (2010) where teachers tended to use computers for surfing internet more than other skills like data processing and spreadsheets.

According to Lillard (1985), the degree of teachers' knowledge in ICT has a positive influence on their attitude towards technology. Similar findings were obtained by Mbithi (2014) in a study on integration of ICT in Instruction of English in Matungulu District of Machakos County in Kenya. His study revealed limited use of ICT in instruction of English in the secondary schools. The outcome was attributed to inadequate training on integration and few deployed TSC teachers of computer. Lentilalu (2015) found that lack of ICT skills was the major factor inhibiting teachers from integrating ICT in teaching in public secondary schools in Samburu North Sub-County. The teachers found use of ICT tools to be time consuming and cumbersome.

A study by Wanami (2010) on Factors influencing integration of computer skills in secondary school curriculum in Kenya gave related outcome where staffs were not fully prepared in relevant skills to enable them integrate computers in the secondary school curriculum and school policy on the use of computers in the classroom was not clearly articulated. Although during the launching of the ESP on integration of ICT teachers were trained in ICT, results of this study did not depict its effect in terms of the ICT pre-requisite skills possessed by teachers. In fact during oral interview one of the teachers had this to say.

> "Oh! There was some training by an ICT champion just before the computers were brought and the internet installed. However the only skill I acquired is that I can now type exams on my own. He also taught us how to draw but I can't remember that anymore."

Another teacher said,

> "We were trained but the ICT champion was an outsider and had a very short time to take us through. The training should have taken slightly longer to enable mastery of the skill. You know he was vast in computer and he may have thought everybody is good. I can't do much using computer on my own."

The younger teachers were however savvy in ICT use as opposed to the older ones though very few of them indicated to occasionally use them for instructional purposes. Most of the responses during oral interaction indicated that many teachers were not using ICT in their daily operations due to lack of the technical knowhow in the computer applications. These tools were used mainly during functions or by visiting motivational speakers who would request for them. One of the senior teachers said in low tones lest walls could hear,

> "The training that the government claims to have given took two days and there was no correlation with the preparations one would need to use the tools in class. Every teacher was busy pushing the syllabus hence no one was ready to assist you if you lack the skill. It is also very humiliating when one tries and the gadgets fail due to power surge, blackouts or ignorance on the application."

The above statement indicated the dissatisfaction by a number of teachers on the Quality of training that they underwent. This confession by the teacher is similar to that established by BECTA (2004), where many teachers were unskilled in ICT and were not prepared to use them in the classroom or in front of the students who might be more familiar than them. Lack of competence in use of ICT accounts for inconsistency between training and usage. Another study by Laara (2013) showed that majority of secondary school teachers were not competent to facilitate use of ICT in schools. Their level of training was far from being satisfactory due to lack of proper exposure during formative training in initial teacher training institutions. Further, the seminars and conferences during in-service courses could not give enough time for teachers to practice well with ICT tools. Teacher training in ICT should be appropriate to classroom use, have hands-on practice and avail on-the-spot help. Analysis of proficiency of teachers in data processing and spread sheets with mean responses of 3.8 and 3.7 respectively, presents a need to equip teachers with the necessary skills in ICT.

Sentiments by a senior teacher were;

> "We need proper training in ICT but with my meagre salary and the employers' irritating statement can't pay won't pay during the teachers' strike, I can't afford to use it for the training! They should fund my training."

This statement unearths the challenges accompanying the effort to use ICT in schools. However, these statements reveal presence of a negative attitude by some teachers. A senior teacher from a well renowned performing school in Agriculture said,

> "I have taught Agriculture for over 20 years without ICT. I have very little knowledge in computer and those who know it cannot beat me in terms of the mean grade I attain in my subject. However, given the guidance and relevant material I can use."

This statement confirms the notion where the older teachers found it needless to strain using the new technology where they had little or no experience. It conformed to the findings by Haji (2015) who found that teachers who had taught for less than twenty years had a more positive attitude towards ICT than those who had taught for more than twenty years.

3.11Adoption and Use of ICT

This aspect was evaluated via a number of components among them: Use of Computers, Use of LCD projectors; Use of internet; Use of software; Use of IT for instructional support; Use of IT for teaching and use of IT for student evaluation as shown by table 8 below

Table 8: Adoption and Use of ICT by Teachers

Item /Use	Not at All	Less Extent	Average	Some Extent	A great Extent
Computers	4.9%	15.6%	25.0%	22.5%	32.0%
Projectors	25.4%	29.1%	19.7%	18.4%	16.0%
Printers	2.5%	10.2%	18.4%	14.8%	19.3%
Internet	12.7%	17.6%	16.5%	26.6%	18.4%
Software	12.7%	21.7%	27.9%	21.7%	16.0%
IT with Peers	16.4%	16.0%	18.0%	22.1%	27.5%
IT for Student Evaluation	13.9%	16.0%	19.3%	18.4%	32.4%

The term less extent meant a teacher using the item once in a week, average was twice in a week, some extent meant thrice in a week while a great extent was on daily basis. Response indicated that 32.0 % of the teachers use computers to a great extent; only 7.4% used projectors to a great extent while teachers who used printers to a great extent were 54.1%. This data implies that most teachers were not using the projectors which are gadgets for power point presentation. The highest percentage of use of printers was attributed to printing examination papers and analysis of results. Basing on this information, the level of adoption in the sampled public secondary schools was low.

These findings were in agreement with the theory of Diffusion of innovation by Rodgers (1995) where individuals are said to possess different degrees of willingness to adopt innovations. The process of adoption would take off with teachers who are aggressive, venturesome and interested with new ideas. Rodgers refers to them as innovators and early adopters and account for 2.5% and 13.5 % respectively. Such a group are the first to try an innovation, are aware of the need for change and hence comfortable adopting new ideas. Majority of the teachers fall in the middle category called early and late majority. They adopt the innovation on seeing the possibility of adoption from others. It is therefore important that information on teachers who have succeeded in the adoption and use of ICT be disseminated. Hennessy, Harrison and Wamakote (2010), also stated that primary barriers to teachers readiness and confidence in using ICT despite general enthusiasm and belief in benefits for the learner is lack of relevant preparedness either initial or in-service. Some teachers lacked necessary skills hence adoption of ICT was low.

The sample schools were beneficiaries of ICT ESP programme hence had the relevant infrastructure and tools to enable them use ICT. This confirms Dede (2000) and Hennessy *et al*. (2010), who asserted that mere presence of ICT equipment and resources in schools did not necessarily ensure appropriate application. A lot needs to be done to ensure success of the programme.

An interview with a senior teacher in one school gave this response

> "We are among the beneficiaries of the ICT programme. However teachers are afraid of using them after a neighboring school had all its ICT gadgets stolen a week after delivery. One computer with a printer is under the custody of the secretary who uses them while the rest are well locked up in the store."

The senior teacher confirmed that none of their staff was using ICT in teaching but were using the conventional way as they were taught in teacher training colleges. It was not vivid whether this was technophobia, fear of maintenance or accountability. The statement indicated that teachers in the school never made an effort to adopt and hence use ICT in their respective tasks. These findings were similar to those by Haji (2015) in a study on science teachers in Cameroon where 66.4% of the teachers were computer literate while 33.6% had no basic knowledge about the use of computers.

Another study by Ang'ondi (2013) on use of ICT in teaching and learning as observed by ICT champions quoted some factors that were barring teachers from using ICT. Among these factors were lack of knowledge and skills on how to integrate ICT, lack of time for training programmes and technical fault with ICT equipment.

In another case, a teacher who did not want to be quoted had this to say,

> "I don't use ICT but I used to take students to the ICT room to do research especially when I had some commitment. However I stopped taking them after realizing that they were instead watching football, going to Facebook or visiting some funny sites."

Teachers in the ESP schools need a clear direction on the expectations of the programme and be prepared in terms of Knowledge and ICT manipulative skills.

3.12Variable Reduction

Factor analysis was used to explore the data for patterns, reduce the many variables to manageable number, group variable with similar characteristics and confirm hypotheses. Factor analyses were conducted on the independent variable; teachers' pre-requisite ICT skills and dependent variable; adoption and use of ICT.

3.13Factor Analysis on Teachers' ICT Pre-requisite skills.

Factor analysis is a combination of statistics and is used to reduce questionnaire items into a smaller number of dimensions. It groups items that are highly correlated with each other. If the grouping of items is measuring one underlying concept, then one factor / dimension should be extracted. The thresh hold level for uni-dimensionality is 50% of the variance explained. Also a factor loading score of each item should be greater than 0.40 for it to be considered significant (Hair et al, 1998).

Teachers' ICT pre-requisite skills were conceptualized to be measured using six items proposed by the study. These were; skills in word processing: skills in data processing: skills in spread sheets: skills in power point presentations: skills in internet and skills in e-mail. The Kaiser Meyer-Olkin measure for sampling (0.793) and Bartlett's test of sphericity($p<0.001$) revealed that data was adequate for extraction of principal component. To asses construct validity and reduce these items into a smaller number of dimensions, an exploratory factor analysis (principal component analysis) was performed on the six items. The items were reduced by factor analysis to one component to represent the others as in the Table 9 below

Table 1: Factor Analysis of Teachers' ICT Pre-requisite Skills.

	Factor Loading	Eigen value	% of variance	KMO
Component.		3.314	55.235	0.793
Teachers' ICT Skills				
Skill in word processing	0.802			
Skill in data processing	0.759			
Skill in spreadsheets	0.756			
Skill in power point	0.733			
Skill in internet	0.709			
Skill in e-mail	0.703			

Factor analysis is useful to test construct validity of a scale. Skill in word processing ranked the highest in this case with a factor loading of 0.802 with 55.235 of the total variance explained and hence met the requirement for uni-dimensionality. All the items loaded highly on a single component whereby skill in word processing had the highest loading (0.802), skill in data processing (0.759), skill in spreadsheets (0.756), skill in power point (0.733), skill in internet (0.709) and skill in e-mail (0.703). Thus teachers' ICT pre-requisite skill was now represented by the component skill in word processing.

3.14 Factor Analysis on Teachers' Adoption and Use of ICT

Ten items on a Likert scale of 1-5 were used to establish the extent of adoption and use of ICT in the schools. To assess construct validity and to reduce the items into a smaller number of dimensions, factor analysis (Principal Component Analysis) with oblique rotation was performed. Results indicated that adoption and use items could fall into one dimension as shown in Table 10 below.

Table 2: Factor Analysis of Adoption and Use of ICT Items

Item	Factor loading	Eigen value	% of variance	KMO
Component		4.044	50.546	0.868
Adoption and use of ICT				
Use of IT for instructional support	0.837			
Use of IT tools in Teaching	0.803			
Use of computers	0.701			
Use of LCD projectors	0.682			
Use of internet	0.680			
Use of IT software	0.672			
Use of IT for student evaluation	0.654			
Use of printers	0.632			

Use of IT for instructional support ranked the highest among the other components with a factor loading (0.837) with Eigen value of 4.044 and hence represented the others. Use of IT for instructional support met the threshold for uni-dimensionality by having 50.546% of the variance explained. Two out of the ten items on adoption and use of ICT were dropped after factor analysis. These items were use of IT for personal Information and use of IT for -communication with peers since their exclusion increased factor loading. The two items also did not adhere to the threshold of collinearity and had factor loading 0.301 and 0. 34 which were lower than the recommended 0.40. Furthermore the two were not highly related with adoption and use of ICT in education. Thus adoption and use of ICT was represented by the component: use of IT for instructional support.

3.15Inferential Statistics Analyses and Hypotheses Testing

Data collected had been cleaned and screened for missing data, erroneous data entry and outliers making it ready for inferential statistical analyses. Hypotheses $\mathbf{H_{o1}}$ was tested using Pearson's' correlation coefficient. Regression analysis was also done to obtain the regression function for the variables.

3..16 Testing Hypothesis H_{o1}

The hypothesis $\mathbf{H_{o1}}$ "There was no statistically significant relationship between the teachers' pre- requisite ICT skills with adoption and use of ICT in public secondary schools (P<O.05)"was tested using Pearson's correlation coefficient as shown in Table 11 below.

Table 11: Pearson's Correlation of ICT skills and Adoption and Use of ICT

		Use of IT for Instructional Support(Use of ICT)
Skill of Respondents in Word Processing(Pre-requisite skills)	Pearson's Correlation	0.154
	Sig 2- tailed	0.016

Correlation is significant at 0.05 level 2- tailed

Results indicated presence of a correlation between teachers' ICT pre- requisite skills and adoption and use of ICT in secondary schools. A correlation of +0.154 was obtained which was positive albeit on small magnitude. This could be attributed to the lack of skills by some teachers and also the level of ICT which had not been sufficiently entrenched in the school process. According to Wiesma (2000), the relationships between two variables can take on values from

-1.00 to +1.00 and the greater the absolute value of the coefficient the stronger the relationship. The correlation coefficient of + 0.154 was a positive relationship albeit on small magnitude. Given the p value was 0.016 which was less than p = 0.05, it was significant and hence the hypothesis H_{o1} "There was no statistically significant relationship between the teachers' pre- requisite ICT skills with adoption and use of ICT in public secondary schools (P<O.05) was rejected. The null hypothesis which read, "There was a statistically significant relationship between the teachers' pre-requisite ICT skills with adoption and use of ICT in public secondary schools" was thus adopted.

3.17Test for Regression Assumptions

Linear regression is used to model the value of a dependent variable on linear relationship to one or more predictors. Regression analysis requires that certain assumptions are observed. Before regression analysis was done the study tested regression assumptions which included; level of measurement, sample size, normality and linearity of the data.

3.17.1 Level of Measurement

Multiple regression analysis requires that the dependent variable be continuous and the independent variable be continuous or categorical (Jaccard&Turisi, 2003: Hayes, 2013). The dependent variables for this study; Teachers pre requisite ICT skills was continuous. The dependent variable, adoption and use of ICT was also continuous hence met the regression assumptions.

3.17.2 Sample size

According to Hair, et al (2005), large sample size increases the statistical power of the model by reducing sampling error effect. Multivariate regression analysis require that the minimum ratio of valid cases to independent variables be at least five to one (5:1).The number of valid cases for this study were 244 to one independent variables. The ratio was 244:1 hence met the requirement.

3.17.3 Test for normality of data

Data had earlier on been cleaned and screened for outliers which were found and dealt with by being deleted case wise. Normality of data distribution was assessed through visual inspection of histograms and Quartile-Quartile (Q-Q) plots. From the histograms data clustered around a central value (mesokurtic) which meant that data was normal. There was no striking pattern, suggesting no significant departure from normality (Norusis, 1994b).

3.18Regression Analysis

Regression or modelling according to Rawlings, Pantula& Dickey (1998), refers to development of a mathematical expression that describes the behaviour of a random variable of interest called the dependent variable denoted Y. The mean of this variable changes with changing conditions. Other variables thought to provide information on the behaviour of this dependent variable Y are incorporated into the model as predictor or explanatory variable denoted by X.

This study was based on the dependent variable 'adoption and use of ICT by secondary school teachers in Kenya and the independent variable 'teachers' ICT pre-requisite skills. This study established correlation between the independent variable and the dependent variable. The functional relationship for the model was as shown

$Y_i = B_o + B_1X_i + e_i$

Where X_{i1} was ICT pre- requisite skills

After carrying out a linear regression analysis, the results obtained were as shown in table 12 below.

Table 12: Coefficients

1	Unstandardized coefficients		Standardized coefficient	T	Sig	Correlations			Collinearity Statistics	
Model	B	std error.	Beta			Zero order.	Partial.	Part	Tolerance	VIF.
Constant	1.03	0.59		1.77	0.07					
Skill in word processing	0.16	0.09	0.12	1.81	0.02	0.15	0.116	0.12	0.91	1.10

Substituting the coefficient from the table gives the regression equation

$Y = 1.03 + 0.12_{x1} + + 0.59$

Where

x_1 is the variable teachers ICT pre – requisite skills

From Table 12 above on coefficients of the linear regression, the model was positive. The first section of the table showed coefficients which were significant indicating that the variable was contributing to the model. The table also showed predictor variable's values of the partial and part didn't deviate from the zero order which confirmed that there was no problem of multi-collinearity since factor analysis had already been done. The tolerance is the percentage of variance in a given predictor that cannot be explained by other predictors. The tolerances of, 91% for the predictor was quite high implying that only 1% to 9% of the variance is what could be explained by other predictors. Further, since the tolerances was far from zero, the concept of multi - collinearity was ruled out. In cases where multicollinearity is a problem, the variance inflation factor (VIF) would be greater than 2.0 hence not applying to this study. The VIF for this case were 1.10.

IV. CONCLUSIONS

This study was a baseline survey on adoption and use of ICT in ESP beneficiary Public secondary schools in Kenya. It investigated the effect of teachers' pre-requisite ICT skill on adoption and use of ICT. A sample of 384 teachers participated in the study whose target population was 30,080 secondary school teachers.

The study established that most teachers were not well equipped with the necessary ICT skills to enable adoption and use of ICT in public secondary schools. Many of these teachers (70%) lacked the skills in data processing, spread sheets and PowerPoint. Their mean responses on these skills were all below 4.00 on a five point Likert scale. However, skills in word processing, internet and e-mail had mean responses slightly above 4.00. Thus most of the teachers (90%) agreed to possess these skills though not strongly. These findings were similar to those by Haji (2015) in a study on science teachers in Cameroon where 66.4% of the teachers were computer literate while 33.6% had no basic knowledge about the use of computers. In an analogous study by BECTA (2004), many teachers unskilled in ICT were not prepared to use them in the classroom or in front of students who might probably be more familiar than them.

The study found a correlation between teachers' ICT pre-requisite skills with adoption and use of ICT of + 0.154 with $p = 0.016$. The value $p<0.05$ and hence the null hypothesis was rejected and the alternative hypothesis Ha1 that read 'there was a statistically significant relationship between teachers ICT pre requisite skills and adoption and use of ICT in public secondary schools' was adopted

V. RECOMMENDATIONS.

The study recommends a follow up and support of the programme to enable adoption and use ICT in secondary schools. This is due to the fact that the ICT tools present in most schools were not sufficiently put to use by the teachers and some still thought ICT would apply best in computer studies only. The study envisaged a review of the tertiary education curriculum to reflect more courses in ICT both for pre-service teacher training institutions and in-service programmes for teachers. These courses should provide an opportunity for the teachers to practically use the computer and the internet allowing sufficient support and time for teachers to get grip of the new technologies.

It was also established that some of the ICT tools had stalled while those in good condition were inadequate. The study therefore recommends the establishment of the source of funds for maintenance, repairs and further acquisition of the necessary infrastructure amid enrolment explosion in public secondary schools. There is also need for monitoring the state of ICT facilities in the ESP beneficiary Schools and evaluation to determine those facilities that need replacement or upgrading for effective ICT adoption and use.

The secondary school curriculum was not clear on the role of ICT and many teachers were using their noble gesture. The study recommends clarity on use of ICT and digital content to be availed to teachers for use to familiarize the teachers and trigger further innovation. The government through the ministry of education and ICT should roll out the Economic Stimulus Programme (ESP) to all secondary schools in the country

VI. RECOMMENDATIONS FOR FURTHER RESEARCH

A similar study needs to be carried out in private secondary schools to establish the status of ICT adoption and use amid the dawn of technology in secondary education.

REFERENCES

[1]. Tinio, V.L. ICT in Education: UN Development Programme. (Retrieved from http:www.eprmers.org on December 2009) (2002).

[2]. Steyn, J. &Johanson, G. *ICTs and Sustainable Solutions for the Digital Divide: Theory and Perspectives*.(Hershey, PA: Information Science Reference. 2011

[3]. Sosin, K., Blecha, B. J., Agawal, R., Bartlett, R. L.,Daniel, J.I. Efficiency in the use of Technology in Economic Education. Some Preliminary Results.*American Economic Review* 2004,253-258.

[4]. Kulik, J. A. Meta- Analysis study of findings on Computer Based Instruction. . 1994.

[5]. Hennessy, S., Harrison, D., &Wamakote, L. (Teacher Factors Influencing Classroom Use of ICT in Sub- Saharan Africa. *Itupale Online Journal of African Studies*, **2**, 2010.39-54 http://aav.org/papers/josphus-anamuah-mensah-full20pdfhttp://www.ac.ke/usiu-old/sbs/kenya%20E-readiness%20Report%2020002.pdf.23/11/2010Marah O' L. (2010).*Integrating ICT into India*. Asia: Promethean.

[6]. Wallet, P. and Melgar, B.V. Information and Communication Technology (ICT) in Education in Asia: A Comparative Analysis of ICT Integration and E-Readiness in Schools across Asia. (UNESCO Institute for Statistics, Montreal.2014).

[7]. Petrogiannis, K. The Relationship Between Perceived Preparedness for Computer Use and other Psychological Constructs Among Kindergarten Teachers With and Without Computer Experience in Greece. *Journal of Information Technology Impact***10** (2) ,2010, 99-110.

[8]. Ford, M.On the Bumpy Information Highway.Computers and Composition.*Technologizing Africa,***24** (3),2007, 302 -316.

[9]. Temba.*ICT Economic Stimulus Programme (ESP).* A Paper Presented During the Training of Principals at KEMI in Nairobi 28th may to 2nd June 2012.

[10]. Manduku, J. Kosgey, A.& Sang , H. *Adoption and use of ICT in enhancing management of Public secondary schools: A Survey of KessesZoneSecondary schools in Wareng district UasnGishu County ,Kenya.*2012

[11]. Murithi ,N .&Indoshe , C. F. Attitude of Teachers and Students towards use of Computers in Teaching Computer Studies in Secondary Schools in North Imenti District Kenya. *International Journal of Current Research*.2014.

[12]. Cresswell, W. J. *Research Design: Qualitative, Quantitative and Mixed Methods Approaches.* (California: Sage Publications. 2009)

[13]. Cherryholmes, C. H. Pragmatism and Scientific Realism. *Educational Researcher*(14)1992,13-37.

[14]. Wiersma, W. *Research Methods in Education. An Introduction* .7th Edition.(Gould Street, USA: Pearson Education publishers.2000)

[15]. Mitchell, M. &jolley, J. *Research design Explained.* (3rdEd.).(Fort WorthTex: Harcort Brace,1996)

[16]. Gay, L., *Educational Research competencies for Analysis and Applications* .4th Edition.(Macmillan Publishers. New York. USA.2002)

[17]. Mugenda, M.O. &Mugenada, G.A.*Research Methods. Quantitative and Qualitative Approaches* .(Nairobi.)African Centre for Technology Studies.1999).

[18]. Krejcie , R.V, & Morgan , D. W. Determining Sample Size for Research Activities. *Education and Psychological Measurement*.**30,**1970, 607- 610.

[19]. Laaria, M. Implementation of ICT in Kenyan Public Secondary Schools: A review of Personal Characteristics Influencing Teachers' Adoption and integration of the technology into teaching. *Research Journal of Social Science & Management3(2),*2013.

[20]. Mc Millan, H.J., & Schumacher, S.*Research in Education, A Conceptual Introduction*. (New York .Longman, 2001).

[21]. Tabachnic, B. G. &Fidell, L.S. *Using Multivariate Statistics* (5th Ed.). (Boston. MA.Allyn& Bacon.2007).

[22]. Jaccard, J. &Turrisi, R. *Interaction Effects in Multiple Regression (2nd Ed.).*(Thousan Oaks .Sage Publications.2013.)

[23]. Norusis, M. J. *SPSS advanced Statistics* (Chicago IL: SPSS Inc.1994b)

[24]. Haji,S.A. Science Teachers' Attitudes towards the Use of Information and Communication Technology in Cameroon. *International Journal of Science and Humanities Research***3**(2),2015, 573-585.

[25]. Lillard , D.*A Survey of Warren County Teachers Concerning the Instructional Use of Micro Computers* .(ERIC Document Reproduction Service NO. ED264224)1985

[26]. Lentilalu, L. *Teacher Factors Influencing Integration of Information Communication Technology in Teaching and Learning in Public Secondary Schools in Samburu North Sub-County. Kenya.*(Unpublished Masters' Thesis Submitted to the University of Nairobi.2015).

[27]. Wanami, I. S. *Factors Influencing Integration of Computer Skills in the Secondary School Curriculum in Kenya.* A Doctor of Philosophy Thesis .MoiUniversity,Eldoret , Kenya.. 2010.

[28]. Ang'ondi, E. K. Teachers' attitudes and Perceptions on the Use of ICT in teaching and Learning as Observed by ICT Champions. *X world Conference on Computers in Education. Torun, Poland.* 2013,21-28

[29]. Hair , J.F. Jn., Anderson, R.E.,Tatham, R. L., & Black, W. C. *Multivariate Data Analysis(5th Edition).* (Upper Saddle River, NJ: Prentice Hall.1998).

[30]. Hayes, A. F. *Introduction to Mediation, Moderation Conditional process Analysis: Regression Based Approach.*(New York. Guilford Press.2013).