

The Relationship between Teacher Characteristics and Information and Communication Technology (ICT) Integration in Public Secondary Schools in Nakuru Town Sub-County, Kenya

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Abstract

This study sought to examine the relationship between teacher characteristics and ICT integration in public secondary schools in Nakuru Town Sub-county. The objectives of the study were: To establish the relationship between attitude and ICT integration; to establish the relationship between motivation and ICT integration, and to determine the overall effect of teacher characteristics on ICT integration. This study employed a descriptive analysis. The data was analyzed quantitatively. The study adopted a descriptive research design. Primary data was collected using a self-administered questionnaire. The relationship between teacher characteristics and ICT integration was tested statistically using Pearson Moments Correlation. Relationships between teacher characteristics and ICT integration in public secondary schools was determined at the alpha level of $p < 0.05$. To describe the various elements of teacher characteristics on overall ICT integration, descriptive analysis (percentages) was done. Data was presented using tables. The purposive sampling design was used in the study where one Headteacher, one Head of ICT Department and one ICT teacher were purposively sampled from each of the 22 public secondary schools yielding a sample size of 66 teachers. The study established that teachers' characteristics affect ICT integration positively. The study is beneficial to policy makers when developing teacher programs; it also helps teachers to see that intervention programs can influence their instructional behaviors; and it also provides evidence to researchers that teacher beliefs can be challenged. The study thus recommends that policymakers should incorporate the actual use of ICT when developing teacher programs. Considering the influence of the teacher characteristics on classroom use of ICT, professional teacher development should be aware of the direct impact of these variables, especially the role of teacher ICT motivation.

Keywords: *Teacher characteristics, ICT integration, Attitude, Motivation.*

1. Introduction

At the start of the 1980s, developed countries made it compulsory for ICT to be integrated into their education system. This was not the case in developing nations such as Kenya, where ICT integration in education is considerably more recent, small-scale and experimental (Mwololo, 2005). Also, the limited and uncoordinated approach to imparting appropriate ICT skills and competencies to teachers remains the main hindrance to ICT integration in education in Africa and Kenya in particular.

1.1 Background to the Problem

The Government of Kenya has acknowledged that purchasing and placing computers in a classroom are not true technology integration. Hence, the National ICT Strategy for Education and Training June 2006 Policy document emphasizes that real integration takes place when technology is effectively applied to a curriculum and students' learning. The policy stresses integrating ICT in teaching the curriculum at all levels of education (Ministry of Education Policy Document, 2006). The policy envisages that through the effective use of technology in the schooling process, students will be able to use technology in their studies. It also acknowledges that it is the classroom teacher who will be instrumental in achieving all this integration of technology. Ertmer (2005) also wrote that the key individual in helping students develop those capabilities is the classroom teacher.

Significant social and economic development can be achieved by countries that have tapped the potential of Information and Communication Technologies (ICTs). They are also rapidly transforming into information and knowledge-based economies. In Kenya, the legal framework for ICT integration is mostly embedded in the Information and Communications Act (Cap 411a) of 1998 that provides for the establishment of the Communications Commission of Kenya (now Communications Authority of Kenya), to facilitate the development of the ICT sector and electronic commerce. Various policy and legal

frameworks of ICT integration in education have been put in place. Teachers are the people at the centre of the implementation of these new technologies but their abilities to respond to this change and innovation that is an essential factor for success has not been fully studied and documented hence the need for this research. Understanding how teachers' characteristics affect ICT integration will enable systems to be designed to enable the teacher who uses the system.

1.1.1 National Policy Framework for ICT Integration

The National policy framework for ICT integration focuses on Kenya Vision 2030; the National ICT policy and the E-government strategy. The social pillar of Vision 2030 mandates the Ministry of Education to provide a quality education that produces a highly skilled human capital with requisite ICT skills to competitively participate in the knowledge-based economy. ICT is identified as the catalyst to drive the socio-economic transformation of Kenya into a middle-income country. The National ICT Policy, 2006 (the Republic of Kenya, 2006) outlines its goals as supporting ICT development, investment, and application; ensuring affordability and access to ICT nationally; supporting research development in ICT and developing an institutional framework for policy formulation and review. One of its objectives is to encourage the use of IT in schools, universities, to improve the quality of teaching and learning. The realization of this policy goal heavily depends on the availability and adequacy of skilled human resource capacity. The Government supports the creation of the necessary capacity by integrating IT subjects in the curriculum at all levels of education; establishing educational networks for sharing educational resources and promoting e-learning at all levels; establishing the establishment of ICT Centres of Excellence and enhancing capacity for research and development in IT. Since it is the teachers who must implement this ICT integration in schools, their understanding and experience are crucial if integration is going to be successful. This motivated our current research.

1.1.2 Education Policy Framework for ICT Integration

The Sessional Paper No. 14 of 2012 (Republic of Kenya, 2012) is the current policy framework through which the Ministry of Education affirms commitment to enhancing access to education, promote equity and increase transition rates in its quest for provision of quality education. The policy underscores the ministry's commitment to competency-based teaching and learning that promotes acquisition of the 21st-century skills and attitudes. Integration of ICT across all levels of subjects and education is envisaged to enhance 21st-century learning skills among others. The Sessional Paper No. 1 of 2005 (The Republic of Kenya, 2005) emphasized that ICT played a crucial role in promoting the economic development of a country. It noted that ICT could be used in education, training, and research as well as in the management of the education sector and that the successful implementation of ICT would require highly skilled human resources. The objectives were to support ICT teacher development, research and development of ICT in education. To implement the ICT policies in this paper, the strategy to reform the curriculum to facilitate use of ICT integration was formulated. Therefore, for this process to be meaningful, its effectiveness must be proven in terms of the personal and professional growth of all involved. Hence the need for this research study.

1.1.3 The Education Strategic Plan

The strategic plan of the Ministry of Education Science and Technology (MOEST) considers and proposes that ICT can contribute substantially towards achieving most of the objectives. Additionally, ICT will support the implementation of Free Primary Education (FPE) and the challenges of overcrowded classrooms, high Pupil Teacher Ratios (PTRs), shortage of teachers on certain subjects or areas, and relatively high cost of learning and teaching materials. The areas of priority under this education plan include; training, research and development and integration of ICTs in education. The classroom teacher plays a crucial factor in the full development and use of technology in schools. This classroom technology needs to be transformed from hardware, software, and connection into tools for teaching and learning and this depends on teachers who are knowledgeable, enthusiastic, motivated and prepared to put technology to work on behalf of their students. Hence the need for this research to establish the relationship between motivation and ICT integration in schools.

1.1.4 Reforms related to ICT integration in the education sector

The Government of Kenya has carried out various reforms related to ICT integration in the education sector. These include; development of an ICT integration model which emphasizes four key pillars critical to effective implementation of ICT initiatives, creation of specialized units – ICT for Education (ICT4E), National ICT innovation and integration centre (NI3C), ICT unit and ICT integration team. The ICT4E unit is mandated to spearhead the pedagogical use of ICTs. The NI3C center is mandated to carry out the testing of technical solutions submitted for consideration by firms to establish their appropriateness and use in curriculum delivery. The ICT integration team's role is – coordination and harmonization of all ICT initiatives in the sector. The ICT unit handles ICT technical support and advice, technical support and systems for EMIS and make reports to the Principal Secretary on ICT matters.

1.1.5 Education initiatives related to ICT integration

Two major ICT initiatives have been made in the education sector, namely the Economic Stimulus Program (ESP) ICT

initiative (the Republic of Kenya, 2013) and the ICT integration/Laptop Project (Republic of Kenya, 2013). The objective of the ESP ICT integration program is to jumpstart ICT integration in education in line with Kenya Vision 2030 so as to produce a highly skilled human resource to transform Kenya into a middle income, knowledge-based economy. The ICT integration/Laptop program has its origin in President Uhuru Kenyatta's campaign pledge to provide laptop computers for every standard one pupil in Kenya government schools. This promise is consistent with current educational trends and practices and will usher Kenyan children into the digital age as the country moves forward to Vision 2030. The laptop program is timely because computer literacy in the 21st century is just as important as the 3Rs (reading, writing and arithmetic) of the early 20th century. This is an indication that the school education system is experiencing significant pressure to change. As schools change, the work of teachers is also changing. It is, therefore, important to establish those characteristics that make teachers adopt and integrate technology into teaching.

1.1.6 Nakuru Town Sub-county

Nakuru Town Sub-county is located within Nakuru town. Nakuru is the capital of Nakuru County and former capital of the Rift Valley Province. It is an important educational center with both public and private institutions. There are 22 public secondary schools in Nakuru Town Sub-county of Nakuru County (see Appendix III). Out of these, one is a girls' day school, one is a girls' boarding school, one is both boys' boarding and mixed day school, one is a boys' boarding school, and eighteen are mixed day schools. There are two national schools, five county schools, and 15 district schools.

1.2 Statement of the Problem

In this 21st century, the world is moving rapidly towards the use of ICT resources. The call for the application of ICT in secondary education is to infuse and inject efficiency and effectiveness in curriculum implementation. The person charged with implementing this is the classroom teacher. The background information indicates that Kenya has an ICT policy and legal framework of ICT integration in education. The teachers are faced with some challenges concerning the adoption of ICTs in educational management. This has resulted in a slow rate of adoption of ICT in schools. As such, this study sought to establish the relationship between teacher characteristics and ICT integration in public secondary schools in Nakuru Town sub-county.

1.3 Objective of the Study

The study aimed at establishing the relationship between teacher characteristics and ICT integration in Public secondary schools in Nakuru Town Sub-county.

Specifically, the study aimed at:

- i) Determine the relationship between attitude and ICT integration.
- ii) Establish the relationship between motivation and ICT integration.
- iii) Examine the composite effect of teacher characteristics on ICT integration.

1.4 Hypotheses

H₀₁. There is no statistical significant relationship between attitude and ICT integration.

H₀₂. There is no significant statistical relationship between motivation and ICT integration.

2. Literature Review

2.1 Introduction

Integrating ICT in education is high on the government's educational reform agenda (Ministry of Education Policy Document, 2006). The term ICT (information and communications technology) refers to the range of hardware, software applications and information systems – Intranet and The Internet (Hennessy et al., 2005). Pelgrum (2001) observed that ICT can accelerate reforms in the educational sector which can change students into productive knowledge workers in this information society era. ICT has the potential to enrich learning environment that allow learners to foster flexible knowledge construction in complex learning domains. In 1993, Marcinkiewicz pointed out that to fully integrate ICT into the education system, there is a need to reconcile teachers and computers. Oliver (1993) states that teachers who received formal training in ICT use hardly differ from those not trained when it comes to the future use of computers. Thus more seems to play a role that influences the educational use of ICT by teachers.

2.2 Theoretical Framework

This study is mainly based on the technology acceptance model (TAM) theory. It looks at the way specific variables are positioned and interlinked.

2.2.1 The Technology Acceptance Model (TAM)

Technology acceptance model (TAM) was developed to study how an individual accepts the technology. Defined by Davis in 1989 it has two beliefs: perceived usefulness and perceived ease of use. These two determine the user's attitude towards

adopting new technologies. TAM has explicitly been developed to describe and explain technology adoption and use. The TAM theorizes that using technology is mainly determined by the individual's belief in its perceived usefulness and perceived ease of use. Perceived ease of use influences the behavioral intention to use the technology that then determines actual adoption and use of technology (Venkatesh & Davis, 2000).

TAM is a widely used theory in Information Systems literature. It has two beliefs, namely perceived usefulness and perceived ease of use. These two predict attitudes, which in turn influence intention to use technology and this plan consequently impacts on the actual use. TAM model theorizes that people who perceive technology as useful and easy to use will accept it more readily than those who do not. Hence the use of TAM model in this research.

2.3 Teacher Characteristics

Ertmer (2005) showed how teachers have a great responsibility of deciding when and how to use technologies for instruction. He observed that few teachers integrate ICT into their teaching activities despite the increased availability of ICT hardware, school-related support for ICT integration, and a larger consciousness of teachers about the importance of educational ICT use. This is a clear indication that there are other factors, other than technical knowledge and skills that seem to contribute to teachers' successful technology integration. Cuban (1993) stressed the importance of knowledge, beliefs, and attitudes of teachers, in shaping what teachers choose to do in their classrooms. He also explained the core of instructional practices that have endured over time. Hence the necessities to consider those barriers that are related to teacher variables and processes that affect their teaching behavior and approaches towards learning. These teacher characteristics are veiled and deeply rooted in daily practices (Ertmer 2005). Examples of these characteristics are - among others – teacher beliefs, teacher self-efficacy, teacher attitudes and teacher motivation.

2.3.1 Teacher Attitudes towards ICT

Ajzen (1988) described attitude as, "a predisposition to respond favorably or unfavorably to an object, person, or event". Sang, et al. (2010) also emphasized the strong relationship between computer-related attitudes and computer use in education. Huang & Liaw, (2005) studied attitudes toward computers and found that attitude influences teachers' acceptance of the usefulness of technology, and also influences whether teachers integrate ICT into their classroom. According to Mumtaz (2000), schools cannot go far to encourage educational technology use without taking teacher attitudes into consideration. Albirini, A. (2006) has also suggested that, "it is vital to understand the attitudes of the teachers towards ICT since it is only then that it will be possible to encourage them to integrate ICT into their teaching".

Keengwe et al. (2008) found that the attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching. Therefore, to initiate and implement educational technology successfully in school programs depends strongly on the teachers' support and attitudes. If teachers perceive technology programs as neither fulfilling their needs nor their students' needs, "they will not integrate the technology into their teaching and learning." Hew et al. (2007) noted that successful integration of ICT into teaching is influenced by factors such as teachers' attitudes and beliefs towards technology. If these attitudes are positive, then teachers can easily provide useful insight on adoption and integration of ICT into the teaching and learning processes.

One of the most important determinants of the uptake of new technologies is teachers' attitudes to ICT use in education. A majority of teachers perceive ICT to offer advantages to classroom learning, but many also struggle to see specific benefits and methods of use. Balanskat et al. (2007) identified lesson planning as an area where ICT helped teachers work more efficiently, particularly through its ability to support collaboration and resource sharing. He noted that teachers have varying perceptions about their effectiveness when using ICT in the classroom, which can subsequently impact on how much they use technologies in the classroom. Similar studies by Bingimlas (2009) reported that "teachers who are confident in ICT use agree that new technologies help them teach and would like to use them more in the future." Teachers reported a lack of clarity and understanding on the benefit of learning and how to translate it from policy and the curriculum into their pedagogy. Other factors included lack of dedicated time to training and experimenting with ICT, insufficient class length and curricular restraints (Gulbahar & Guven, 2008).

2.3.2 Teacher ICT Motivation

Motivation consists of a multitude of factors that define the selection, persistence and engagement of particular activities to attain an objective (Dweck & Elliott, 1983). It is a process where "goal-directed behavior is instigated and sustained" (Schunk, 1990). Motivational factors are therefore considered to be part of one's goal structures and beliefs about what is important (Ames, 1992). Sufficient levels of motivation in teachers are seen to be related to the innovative role of technology. Empirical research has successfully linked motivation to teacher computer use (Marcinkiewicz H. R., 1996). Motivation serves to create intentions and goal-seeking acts. Motivation to achieve is a function of the individual's desire for success, the expectancy of success, and the incentives provided.

Ajzen's theory (Ajzen, 1988) examines factors leading to actions. When this theory is applied to the motivation of teachers to

use ICT, the uptake of ICT will depend upon the teacher's positive intention to use ICT. This is in turn influenced by the teacher's beliefs about the value of ICT. The requirements of the national curriculum will also influence the use of ICT.

2.4 ICT Integration

The term ICT integration connotes a range of learning environments from a stand-alone computer in a classroom to a situation where the computer does the teaching through pre-packaged teacher-proof courseware. Mwololo (2005) observed that in Kenya, ICT integration in education is dominated by technical aspects. The road to integrating ICT started with the promulgation of a national ICT policy in January 2006. The Ministry of Education through KESSP (Kenya education sector support program) organized two investment programs dealing with the national education curriculum. One was on ICT in Education and the other on Capacity Development. The program also contributes to the application of the National ICT Strategy for Education and Training. It is primarily intended for the ICT for Education Unit, the ICT Integration Team and all managers within the Ministry of Education. It also supports the ICT Unit with technical issues. The teachers are also targeted because through the program; they are stimulated to use ICT to improve their teaching and learning (Ministry of Education Policy Document, 2006). To achieve these goals there is collaboration with the Ministry of Education, ICT work groups within the Ministry of Education such as ICT Integration Team, ICT4E Unit, ICT Unit, KESI (Kenya Education Staff Institute) and CEMASTE (Centre for Mathematics, Science and Technology Education in Africa).

ICT classroom integration consists of two distinctive types of ICT use: supportive use of ICT by teachers and classroom use of ICT that directly depends on teachers.

2.4.1 Supportive ICT Use

Supportive ICT use is the use of ICT for administrative teaching tasks, such as student administration, preparing worksheets, developing evaluation activities, and keeping track of pupils' learning progress.

2.4.2 Classroom ICT Use

Classroom use of ICT is described as learning with, from and through technology. Learning with technology implies an enhancement of learning where the technology is used to amplify student understanding or capacity. This means that ICT is used as a presentation medium. Learning from technology has emerged from the use of the Internet as an information source and from increased use of programmed courseware. Learning through technology extends the notion of amplification and allows for collaboration and reflection both on- and off-line. Classroom ICT use aims to support and enhance the actual teaching and learning process, such as the use of computers for demonstration purposes, drill and practice activities, modeling, representation of complex knowledge elements, discussions, collaboration, project work, etc. (Hogarty et al. 2003).

2.5 Empirical Review

Compeau et al. (1999) conducted a longitudinal study to test the influence of computer self-efficacy beliefs, outcome expectations and anxiety about computer use. They found out that computer self-efficacy beliefs have a significant positive impact on computer use.

Huang & Liaw (2005) in a research on attitudes towards technology found that teachers' attitudes towards technology influenced their acceptance of the usefulness of the technology and its integration into teaching.

Albirini, A. (2006) explored the attitudes of teachers in Syria toward ICT, and the relationship between computer attitudes and personal characteristics. They found that teachers have positive attitudes toward ICT in education, and this showed the importance of teachers' vision of technology itself and their experiences with it.

Balanskat et al. (2007) undertook an extensive research on teachers' perception of ICT use. They found that teachers with highly positive perceptions of ICT impact would use ICT in a more project-oriented, collaborative and experimental way than other teachers. The teachers reported feeling unprepared on how to use ICT in the classroom to support learning. They also reported feeling anxious about using ICT in classes when they perceive that students know more about ICT than they do.

Tondeur et al. (2008) undertook a multiple case study research project in the Belgium. They explored the process of developing a school-based ICT policy plan and the supportive role of ICTs in this process. They interviewed school leaders and ICT coordinators, reviewed school policy documents, and analyzed data from a teacher questionnaire. The results indicated that schools shape their ICT policy based on specific school data collected and presented. School teams also learned about the actual and future place of ICT in teaching and learning, and this resulted in different policy decisions being made according to each school's vision for 'good' education and ICT integration.

Drent & Meelissen (2008) conducted a study on factors that influence the innovative use of ICT by teacher educators in the Netherlands. The study revealed that a positive attitude towards computers by teachers also had a direct positive impact on the innovative use of ICT.

Sorebo et al. (2009) conducted a survey on attitudes and beliefs on the utilization of a Learning Management System. Their

analysis showed that perceived usefulness has a positive prediction of satisfaction and intention to continue using computers.

Teo et al. (2009) examined TAM among pre-service teachers from Singapore and Malaysia. They found that perceived usefulness had a significant, positive impact on attitudes toward computer use and that teachers' attitudes toward computer use had a significant, positive effect on teachers' intentions to use computers. Teo (2009) also conducted a survey on pre-service teachers' attitudes towards computer use in Singapore. He found that teachers who had a positive attitude towards computers also developed a positive intent to use computers.

Demirci (2009) conducted a study in Turkey on teachers' attitudes towards the use of Geographic Information Systems (GIS). From the study, he established that teachers' positive attitudes towards GIS led to its successful integration despite a lack of hardware and software.

Polancic et al. (2010) undertook a study of technology acceptance among 389 subjects. They found that perceived usefulness has a positive impact on the productivity and quality of work with technology. When asked about how they perceived the impact or value of a certain technology, the respondents provided crucial information on perceived usefulness.

In a study of Chinese primary schools, Sang et al. (2010), found out that teachers who are willing to integrate classroom use of ICT are regular users of ICT. This attitude indirectly influences ICT classroom integration through the mediation of ICT motivation and ICT supportive use. Therefore, if secondary school teachers adopt favorable attitudes towards ICT in education, they will be more eager to integrate ICT into their teaching.

Other factors such as access to the technologies (hardware, software, and Internet connectivity), ICT Training, Ministry of Education support, and Workgroups do have a moderating effect on this integration. Unless the technology is made available by the government, then we cannot talk of ICT. Training also needs to be undertaken to enable its efficient use. Ministry of education support is necessary as it is entrusted with curriculum development through Kenya Institute of Curriculum development (KICD).

2.6 Conceptual Framework

The conceptual framework will establish the relationship between teacher educational beliefs, teacher self-efficacy beliefs, and teachers' attitudes towards ICT, ICT motivation, and ICT integration.

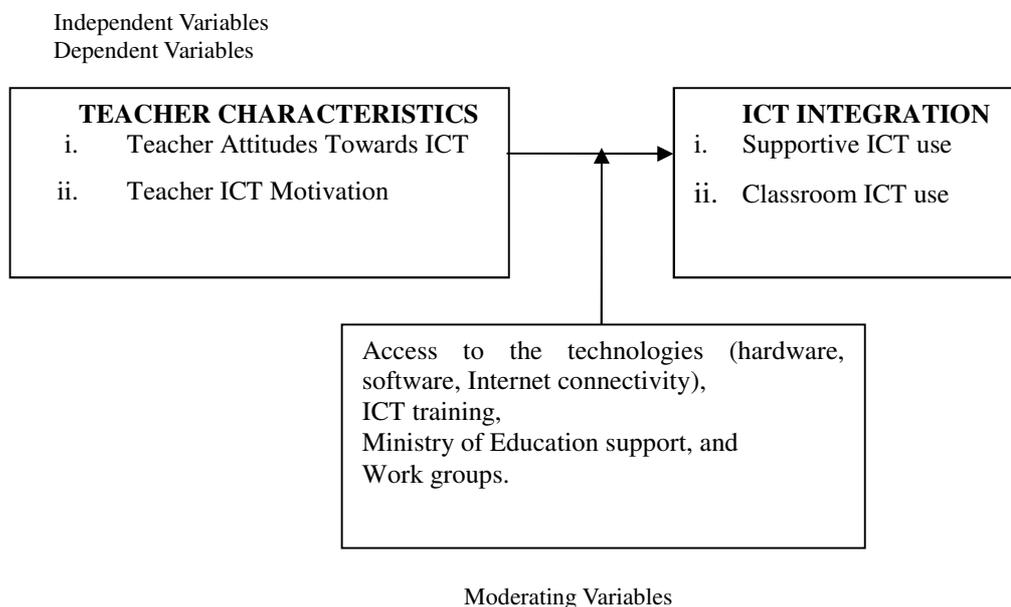


Figure 1: Conceptual Framework

3. Research Methodology

3.1 Introduction

This chapter presents the procedure used in eliciting data from the field. It includes data analysis and compilation, research design, sample population and research instruments.

3.2 Research Design

The study used descriptive analysis. The major purpose of descriptive research is a description of the state of affairs as it

exists and then reporting the findings. Kerlinger & Kaya (1959) points out that, descriptive studies describe the state of affairs as it is. However, it may also lead to formulating of principles and the solution to significant problems. This research also utilized an ex-post facto design because biographic data such as employees' age, experience, qualifications, gender, etc. cannot be manipulated.

3.3 Target Population

The target population was 602 public secondary school teachers in Nakuru Town Sub-county (<http://www.nakuru.go.ke/category/education/>, 2015). Purposive sampling was used to obtain a sample of 66 public secondary school teachers in Nakuru Town Sub-county. The respondents comprised of head teachers, heads of ICT department and ICT teacher(s). The sample population was considered appropriate since they were perceived to be conversant with ICT matters as a result of their professional qualification in their respective positions. The sample frame comprised of public secondary school teachers as shown in table 3.1 below.

Table 3.1 Sampling Frame

Category	Frequency	Percentage
Head teachers	22	33.333
Head of ICT department	22	33.333
ICT teachers	22	33.333
Total	66	100%

3.4 Sample and Sampling Techniques

There are 22 public secondary schools in Nakuru Town Sub-county all having an efficient ICT department. Purposive sampling was applied to identify the actual respondents considered to possess adequate knowledge of the variables under study. A sample of the 22 head teachers, 22 heads of ICT departments and 22 ICT teachers were included in the study. The study, therefore, focused on 66 respondents.

3.5 Research Instruments

To collect primary data, the researcher used closed-ended questionnaire. The researcher used this as it is the most common instrument used in the primary data collection to obtain valuable information about the population. Each item in the questionnaire was developed to address a specific objective or hypothesis of the study. (Mugenda & Mugenda, 2003). This questionnaire was pre-tested randomly on ten (10) ICT teachers in public secondary schools within DUNDORI location in Nakuru North District. The researcher informed the respondents in each of the schools under study before conducting the study and assured them of the utmost privacy and confidentiality. They were assured that any information gathered from their institutions was to be used solely for the academic purpose, and sources would remain confidential. This addressed ethical issues and ensured that the findings do not portray the respective schools in bad or good light without their consent.

3.6 Validity and Reliability

To test the validity and reliability of the questionnaire, a pilot study was carried out. The number of cases in the pretest was 15% of the sample size (Mugenda & Mugenda 2003). This yielded ten (10) teachers who were randomly selected from public secondary schools within DUNDORI location in Nakuru North District. To examine the validity of the questionnaire, content validity was applied and was achieved by seeking an expert opinion to ascertain the consistency of the questionnaire. The pilot study tested the clarity of instructions; relevance, the terminology used and comprehensibility. It also identified potential ambiguity and any other issues that may have arisen and replaced such questions with focused ones. Cronbach's alpha was calculated to determine internal consistency.

3.7 Data Analysis and Presentation

The data was analyzed quantitatively. Biographic data on the respondents was analyzed using descriptive statistics such as percentage values. The questionnaire used close-ended items based on a five-point Likert scale magnitude. The relationship between teacher characteristics and ICT integration was tested using Pearson Moments Correlation. Relationships between teacher characteristics and ICT integration in public secondary schools was determined at the alpha level of $p < 0.05$. To determine the influence of various elements of teacher characteristics on overall ICT integration, factor analysis was done. Regression analysis was used to test the strength and significance of the relationship between the dependent and independent variables. The data was analyzed with the help of Statistical Package for Social Sciences (SPSS) computer program (version 20.0). Before the regression analysis was run, multi-collinearity tests were performed to see whether there was a correlation between the independent variables. The following linear equation model was used:

$$\gamma = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \epsilon$$

Where, γ =ICT integration

x_1 = attitude

x_2 = motivation

β_0 = intercept explaining the level of ICT integration when no teacher characteristic is applied.

β_1 β_2 = coefficients representing the contributions of the various types of teacher characteristics.

ϵ = error

4. Results and Discussion

4.1 Introduction

This chapter presents the general findings from the study, hypothesis tests results, interpretations and discussion on the relationship between teacher characteristics and ICT integration in public secondary schools in Nakuru Town sub-county.

4.2 Descriptive Analysis of Background Information

A total of 66 questionnaires were issued out to respondents. 48 questionnaires were correctly filled and collected by the researcher. This showed a response rate of 73% that was deemed adequate to achieve the study objectives. The respondents' distribution by age is shown in Table 4.1.

Table 4.1 Respondents distribution by age

Age in Years	Frequency	Percent
20-30	8	16.7
31-40	12	25.0
41-50	26	54.2
over 50	2	4.2
Total	48	100.0

From Table 4.1 out of 48 respondents, 16.7% were aged between 20-30, 25% were aged between 31-40, 54.2% were aged between 41-50, and 4.2% were aged over 50 years. This showed that the majority of respondents were aged between 41-50 years.

Distribution of respondents according to teaching experience is shown in Table 4.2

Table 4.2 Teaching Experience of Respondents

Teaching Experience in Years	Frequency	Percent
1-5	11	22.9
6-10	8	16.7
11-15	2	4.2
over 15	27	56.3
Total	48	100.0

Table 4.2 shows that 22.9% of the respondents had 1-5 years teaching experience, 16.7% had 6-10 years teaching experience, 4.2% had 11-15 years teaching experience and 56.3% had over 15 years teaching experience. This showed that majority of teachers had over 15 years teaching experience.

Distribution of respondents according to highest qualification is shown in Table 4.3

Table 4.3 Highest Qualification of Respondents

Highest Qualification	Frequency	Percent
Diploma	5	10.4
Degree	43	89.6
Total	48	100.0

Table 4.3 shows that 10.4% of the respondents had a diploma as their highest qualification while 89.6% had a degree as their highest qualification. This showed that the majority of teachers had a degree as their highest qualification.

Distribution of respondents by gender is shown in Table 4.4

Table 4.4 Distribution of Respondents by Gender

Gender	Frequency	Percent
Male	33	68.8
Female	15	31.3
Total	48	100.0

From Table 4.4 out of 48 respondents, 68.8% were male while 31.3% were female. This showed that majority of teachers were male.

Distribution of respondents according to the position held in school is shown in Table 4.5

Table 4.5 Distribution of Respondents According to Position held in School

Position Held in School	Frequency	Percent
Head teacher	21	43.8
Head of ICT Department	13	27.1
ICT Teacher	14	29.2
Total	48	100.0

From Table 4.5 43.8% of the respondents were Head teachers, 27.1% were Heads of ICT department, and 29.2% were ICT teachers. This showed that majority of respondents were Head teachers.

4.3 Descriptive Analysis on Teacher Characteristics

Teachers' characteristics were studied in terms of attitude towards ICT and ICT motivation. Analysis of the responses is presented in tables 4.6 and 4.7

4.3.1 Attitude towards ICT and ICT Integration

The Respondents' opinions were sought on attitude towards ICT and ICT integration. The respondents were given the following statements relating to the attitude towards ICT. Using the key (Where: 1 - Strongly disagree; 2 – Disagree; 3 – Indifferent; 4 - Agree; 5 – Strongly agree) they were asked to tick one to indicate the extent to which they agreed with each statement. The responses were as presented in Table 4.6.

According to Table 4.6 4.2% of respondents strongly disagreed that the efficiency of the learning process is increased through the use of ICT, 20.8% agreed and 75.0% strongly agreed that the efficiency of the learning process is increased through the use of ICT. When the teachers were asked if the computer provides an opportunity for improving the learning performance, 2.1% strongly disagreed, 41.7% agreed, and 56.3% strongly agreed that the computer provides an opportunity for improving the learning performance. When asked if the efficiency of the learning process is increased through the use of computers, 2.1% of the teachers strongly disagreed, 6.3% were indifferent, 37.5% agreed, and 54.2% strongly agreed. Asked if the computer used as a learning tool, increases student motivation, 2.1% strongly disagreed, 4.2% disagreed, 25.0% agreed, and 68.8% strongly agreed. Asked if students with learning difficulties can strongly benefit from the didactic possibilities that the use of computers entail, 8.3% were indifferent, 41.7% agreed and 50.0% strongly agreed. Asked if the computer increases the level of creativity of students, 2.1% of the teachers strongly disagreed, 16.7% were indifferent, 39.6% agreed and 41.7% strongly agreed. When asked if the use of computer helps students to achieve better text writing, 2.1% strongly disagreed, 12.5% disagreed, 27.1% were indifferent, 41.7% agreed, and 16.7% strongly agreed. Asked if computer knowledge and practical experience should be more integrated into the curriculum, 4.2% of the teachers strongly disagreed, 20.8% agreed, and 75.0% strongly agreed. Asked if computers can help the teacher to apply differentiation among the students, 4.2% of the teachers strongly disagreed, 2.1% disagreed, 6.3% were indifferent, 50.0% agreed, and 37.5% strongly agreed that computers can help the teacher to apply differentiation among the students.

These results show that teachers strongly agree that the efficiency of the learning process is increased through the use of ICT; that the computer provides opportunity for improving the learning performance; that the efficiency of the learning process is increased through the use of computers; that the computer used as a learning tool, increases student motivation, that students with learning difficulties can strongly benefit from the didactic possibilities which the use of computers entail; that the computer increases the level of creativity of students, that the use of computer helps students to achieve better text writing, that computer knowledge and practical experience should be more integrated in the curriculum, and that computers can help the teacher to apply differentiation among the students.

Table 4.6 Attitude Towards ICT and ICT Integration

Statement	Percent (%)				
	Strongly disagree	Disagree	Indifferent	Agree	Strongly agree
The efficiency of the learning process is increased through the use of ICT.	4.2			20.8	75.0
The computer provides an opportunity for improving the learning performance.	2.1			41.7	56.3
The efficiency of the learning process is increased through the use of computers.	2.1		6.3	37.5	54.2
The computer used as a learning tool increases student motivation.	2.1	4.2		25.0	68.8
Students with learning difficulties can strongly benefit from the didactic possibilities which the use of computers entails.			8.3	41.7	50.0
The computer increases the level of creativity of students.	2.1		16.7	39.6	41.7
The use of computer helps students to achieve better text writing.	2.1	12.5	27.1	41.7	16.7
Computer knowledge and practical experience should be more integrated into the curriculum.	4.2			20.8	75.0
Computers can help the teacher to apply differentiation among the students.	4.2	2.1	6.3	50.0	37.5

4.3.2 ICT Motivation and ICT Integration

The Respondents' opinions were sought on ICT motivation and ICT integration. The respondents were given the following statements relating to ICT motivation. Using the key (Where: 1 - Strongly disagree; 2 – Disagree; 3 – Indifferent; 4 - Agree; 5 – Strongly agree) they were asked to tick one to indicate the extent to which they agreed with each statement. The responses were as presented in Table 4.7.

Table 4.7 ICT Motivation and ICT Integration

Statement	Percent (%)				
	Strongly disagree	Disagree	Indifferent	Agree	Strongly agree
I use ICT to prepare children for the information society.	6.3	8.3	12.5	39.6	33.3
I use ICT as a tool for demonstration working with existing presentations, or those that someone else has made for me.	2.1	8.3	10.4	35.4	43.8
I use ICT as a tool to teach new subject knowledge, i.e. the pupils acquire knowledge directly from the computer.	6.3	10.4	12.5	41.7	29.2
I encourage pupils in class to search for relevant information on the Internet.	6.3	6.3	14.6	27.1	45.8
I use ICT as a tool for demonstration working with presentations I have made myself (e.g., PowerPoint).	2.1	12.5	4.2	29.2	52.1
I ask pupils to undertake tasks or follow up class work at home on the computer.	12.5	12.5	22.9	29.2	22.9
I use ICT to assist with differentiation or implementing individual learning plans.	4.2	12.5	12.5	50.0	20.8
I encourage pupils to work collaboratively when using a computer.	8.3	8.3	4.2	31.3	47.9
I use e-mail to communicate with pupils out of school (or class time).	37.5	22.9	8.3	25.0	6.3

According to Table 4.7 6.3% of respondents strongly disagreed that they use ICT to prepare children for the information society, 8.3% disagreed, 12.5% were indifferent, 39.6% agreed and 33.3% strongly agreed that they use ICT to prepare children for the information society. When asked if they use ICT as a tool for demonstration working with existing presentations, or those that someone else has prepared for them, 2.1% strongly disagreed, 8.3% disagreed, 10.4% were indifferent, 35.4% agreed and 43.8% strongly agreed. Asked if they use ICT as a tool to teach new subject knowledge, i.e. the pupils acquire knowledge directly from the computer, 6.3% strongly disagreed, 10.4% disagreed, 12.5% were indifferent, 41.7% agreed, and 29.2% strongly agreed. When asked if they encourage pupils in class to search for relevant information on the Internet, 6.3% strongly disagreed, 6.3% disagreed, 14.6% were indifferent, 27.1% agreed, and 45.8% strongly agreed. Asked if they use ICT as a tool for demonstration working with presentations they have made themselves (e.g. PowerPoint), 2.1% strongly disagreed, 12.5% disagreed, 4.2% were indifferent, 29.2% agreed and 52.1% strongly agreed. When asked if they ask pupils to undertake tasks or follow up class work at home on the computer, 12.5% strongly disagreed, 12.5% disagreed, 22.9% were indifferent, 29.2% agreed, and 22.9% strongly agreed. When the teachers were asked if they use ICT to assist with differentiation or implementing individual learning plans, 4.2% strongly disagreed, 12.5% disagreed, 12.5% were indifferent, 50.0% agreed, and 20.8% strongly agreed. Asked if they encourage pupils to work collaboratively when using a computer, 8.3% strongly disagreed, 8.3% disagreed, 4.2% were indifferent, 31.3% agreed, and 47.9% strongly agreed. Asked if they use e-mail to communicate with pupils out of school (or class time), 37.5% strongly disagreed, 22.9% disagreed, 8.3% were indifferent, 25.0% agreed, and 6.3% strongly agreed.

These results show that generally, teachers use ICT to prepare children for the information society, they use ICT as a tool for demonstration working with existing presentations or those someone else has made for them, they use ICT as a tool to teach

new subject knowledge, i.e. the pupils acquire knowledge directly from the computer. The teachers also encourage pupils in class to search for relevant information on the Internet, they use ICT as a tool for demonstration working with presentations they have made themselves (e.g. PowerPoint), they ask pupils to undertake tasks or follow up class work at home on the computer, they use ICT to assist with differentiation or implementing individual learning plans and they also encourage pupils to work collaboratively when using a computer. The teachers however significantly disagreed that they use e-mail to communicate with pupils out of school (or class time).

4.4 Descriptive Analysis on ICT Integration

In this study, ICT integration was operationalized under two categories; supportive ICT use and classroom use of ICT. Table 4.11 and 4.12 present the analysis of the responses given by the research participants.

4.4.1 Supportive ICT use

The research participants were given statements relating to supportive ICT use. They were asked to rate each statement based on a 5-point Likert scale (where: 1 - Never; 2 - Every term; 3 - Monthly; 4 - Weekly; 5 - Daily) by ticking one to indicate the extent to which they agreed with each statement. The responses are as outlined in Table 4.8

Table 4.8 Responses on Supportive ICT use

Statements on Supportive ICT use.	Per cent (%)				
	Never	Every term	Monthly	Weekly	Daily
I use the computer for administration, e.g. reports, curriculum planning, etc.	2.1	10.4	2.1	27.1	58.3
I would use the computer as a tool for demonstration working with existing presentations, or those presentations someone else has made for me.	4.2	2.1	8.3	37.5	47.9
I would use the computer as a tool for demonstration working with presentations I have made myself (e.g., PowerPoint).		8.3	12.5	33.3	45.8
I would ask pupils to undertake tasks or follow up classwork at home on the computer.	18.8	10.4	22.9	27.1	20.8
I would use the computer to assist with differentiation or implementing individual learning plans.	6.3	14.6	16.7	50.0	12.5
I would use e-mail to communicate with pupils out of school (or class time).	33.3	22.9	12.5	20.8	10.4

According to Table 4.8 2.1% of the respondents never use the computer for administration e.g. reports, curriculum planning, etc., 10.4% use it every term, 2.1% use it monthly, 27.1% use it weekly and 58.3% use the computer daily for administration e.g. reports, curriculum planning, etc. 4.2% of the respondents never use the computer as a tool for demonstration working with existing presentations, or those presentations someone else had made for them, 2.1% use it every term, 8.3% use it monthly, 37.5% used it weekly and 47.9% use the computer daily as a tool for demonstration working with existing presentations or those presentations someone else had made for them. 8.3% of the respondents would use the computer every term as a tool for demonstration working with presentations they have made themselves (e.g. PowerPoint), 12.5% use it monthly, 33.3% use it weekly while 45.8% use the computer daily as a tool for demonstration working with presentations they had made themselves (e.g. PowerPoint). 18.8% of the respondents never asked pupils to undertake tasks or follow up classwork at home on the computer, 10.4% asked every term, 22.9% asked monthly, 27.1% asked weekly while 20.8% asked pupils daily to undertake tasks or follow up classwork on the computer. 6.3% of the respondents never use the computer to assist with differentiation or implementing individual learning plans, 14.6% use it every term, 16.7% use it every month,

50.0% use it weekly while 12.5% use the computer daily to assist with differentiation or implementing individual learning plans. 33.3% of the respondents never use e-mail to communicate with pupils out of school (or class time), 22.9 use it every term, 12.5% use it monthly, 20.8% use it weekly while 10.4% use e-mail daily to communicate with pupils out of school (or class time).

The results show that ICT is used as a supportive tool for administration, for demonstration, for undertaking follow-up classwork and for assisting with differentiation or implementing individual learning plans. However, it has limited use as e-mail to communicate with pupils out of school (or class time).

4.4.2 Classroom use of ICT

The respondents were asked to express their opinion on a list of statements relating to classroom use of ICT. They were asked to rate each statement based on a 5-point Likert scale (where: 1 - Never; 2 – Every term; 3 – Monthly; 4 – Weekly; 5 – Daily) by ticking one to indicate the extent to which they agreed with each statement/ They responded as shown in Table 4.9

Table 4.9 Responses on Classroom use of ICT

Statements on Classroom Use of ICT	Per cent (%)				
	Never	Every term	Monthly	Weekly	Daily
I use ICT for independent work/ individual learning.	8.3	6.3	16.7	31.3	37.5
I would use the computer as a tool to teach new subject knowledge, i.e. the pupils acquire knowledge directly from the computer.	4.2	6.3	14.6	37.5	37.5
I would encourage pupils in class to search for relevant information on the Internet.	8.3	8.3	14.6	29.2	39.6
I would use educational software with my pupils for learning subject knowledge through drill and practice.	8.3	8.3	18.8	29.2	35.4
I would teach pupils to consider the implications and opportunities of computer use.	2.1	4.2	10.4	37.5	45.8
I would I encourage pupils to work collaboratively when using a computer.	2.1	6.3	6.3	39.6	45.8

From Table 4.9 8.3% of respondents never use ICT for independent work/individual learning, 6.3% use it every term, 16.7% use it monthly, 31.3% use it weekly while 37.5% use ICT daily for independent work/individual learning. 4.2% of the respondents never use the computer as a tool to teach new subject knowledge, 6.3% use it every term, 14.6% use it monthly, 37.5% use it weekly while 37.5% use the computer daily as a tool to teach new subject knowledge. 8.3% of the respondents never encourage pupils in class to search for relevant information on the Internet, 8.3% do it every term, 14.6% does it monthly, 29.2% do it weekly while 39.6% encourage pupils in class daily to search for relevant information on the Internet. 8.3% of the respondents never use educational software with their pupils for learning subject knowledge through drill and practice, 8.3 do it every term, 18.8% do it monthly, 29.2% does it weekly while 35.4% would use educational software daily with their pupils for learning subject knowledge through drill and practice. 2.1% of the respondents never teach pupils to consider the implications and opportunities of computer use, 4.2% do it every term, 10.4% does it monthly, 37.5% do it weekly while 45.8% would daily teach pupils to consider the implications and opportunities for computer use. 2.1% of respondents never encourage pupils to work collaboratively when using a computer, 6.3% do so every term, 6.3% do so monthly, 39.6% do so weekly while 45.8% would daily encourage pupils to work collaboratively when using a computer.

4.5 Hypothesis Testing

This study set out to test hypotheses on two predictor variables; attitude towards ICT and ICT motivation. The dependent

variable was ICT integration. In this case, Pearson's Moment Correlation Coefficient was used to study the relationship between these variables and ICT integration at the alpha level of $p < 0.05$.

4.5.1 The Relationship between Attitude and ICT Integration

The first hypothesis was that there was no statistical significant relationship between attitude and ICT integration in public secondary schools in Nakuru Town sub-county. A correlation analysis using Pearson Moment Correlation was conducted, and the results were as indicated in Table 4.10

Table 4.10 Correlation Analysis on Attitude and ICT Integration

		Attitude	ICT Integration
Attitude	Pearson Correlation	1	.504**
	Sig. (1-tailed)		.000
	N	48	48
ICT Integration	Pearson Correlation	.504**	1
	Sig. (1-tailed)	.000	
	N	48	48

****.** Correlation is significant at the 0.01 level (1-tailed).

Pearson correlation (r) indicates the correlation between attitude and dependent variable ICT integration. The r value of 0.504 indicates a positive correlation between attitude and ICT integration. The null hypothesis is thus rejected. The significance value of 0.000 which is less than 0.05 indicates that the relationship is statistically significant. Therefore, it was concluded that attitude has a significant positive relationship with ICT integration statistically. This implies that if public secondary school teachers adopt favorable attitudes towards ICT in education, they are more eager to integrate ICT into their teaching. This finding is in accordance with the findings of previous studies (e.g. Sang, et al 2010, Huang & Liaw, 2005, Mumtaz 2000, Albirini, A. 2006, Keengwe et al 2008, Hew et al 2007, Balanskat et al 2007, Bingimlas 2009 and Gulbahar & Guven, 2008). For instance, Keengwe et al. 2008 found that the attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching.

4.5.2 The Relationship between ICT Motivation and ICT Integration

The second hypothesis was that there was no statistical significant relationship between ICT motivation and ICT integration in public secondary schools in Nakuru Town sub-county. A correlation analysis using Pearson Moment Correlation was conducted and the results were as indicated in Table 4.11.

Table 4.11 Correlation Analysis on Motivation and ICT Integration

		ICT Motivation	ICT Integration
ICT Motivation	Pearson Correlation	1	.495**
	Sig. (1-tailed)		.000
	N	48	48
ICT Integration	Pearson Correlation	.495**	1
	Sig. (1-tailed)	.000	
	N	48	48

****.** Correlation is significant at the 0.01 level (1-tailed).

Pearson correlation (r) indicates the correlation between ICT motivation and dependent variable ICT integration. The r value of 0.495 indicates a positive correlation between ICT motivation and ICT integration. The null hypothesis is thus rejected. The significance value of 0.000 which is less than 0.05 indicates that the relationship is statistically significant. Therefore, it was concluded that ICT motivation has a significant positive relationship with ICT integration statistically. This is consistent

with the findings of Marcinkiewicz H. R., (1996).

5. Conclusions and Recommendations

5.1 Introduction

This section shows a summary of the results obtained from the analysis, the conclusions thereof and recommendations for further research.

5.1.1 Attitude and ICT Integration

The first objective was to determine the relationship between attitude and ICT integration. The study findings revealed that teachers strongly agree that the efficiency of the learning process is increased through the use of ICT; that the computer provides opportunity for improving the learning performance; that the efficiency of the learning process is increased through the use of computers; that the computer used as a learning tool, increases student motivation; that students with learning difficulties can strongly benefit from the didactic possibilities which the use of computers entail; that the computer increases the level of creativity of students; that the use of computer helps students to achieve better text writing; that computer knowledge and practical experience should be more integrated in the curriculum; and that computers can help the teacher to apply differentiation among the students.

Hypothesis test revealed that attitude is positively correlated with ICT integration. The relationship was statistically significant. Therefore, it was concluded that attitude has statistically significant positive relationship with ICT integration. This implies that if public secondary school teachers adopt favorable attitudes towards ICT in education, they are more eager to integrate ICT into their teaching. This finding is in accordance with the findings of previous studies (e.g. Sang, et al. 2010, Huang & Liaw, 2005, Mumtaz 2000, Albirini, 2006, Keengwe et al. 2008, Hew et al. 2007, Balanskat et al. 2007, Bingimlas 2009 and Gulbahar & Guven, 2008). For instance, Keengwe et al. 2008 found that the attitudes of teachers towards technology greatly influence their adoption and integration of computers into their teaching.

5.1.2 Motivation and ICT Integration

The second objective was to establish the relationship between motivation and ICT integration. The study findings revealed that generally, teachers use ICT to prepare children for the information society; they use ICT as a tool for demonstration working with existing presentations or with those someone else has made for them; they use ICT as a tool to teach new subject knowledge, i.e. the pupils acquire knowledge directly from the computer. The teachers also encourage pupils in class to search for relevant information on the Internet; they use ICT as a tool for demonstration working with presentations they have made themselves (e.g. PowerPoint); they ask pupils to undertake tasks or follow up class work at home on the computer; they use ICT to assist with differentiation or implementing individual learning plans, and they also encourage pupils to work collaboratively when using a computer. The teachers however significantly disagreed that they use e-mail to communicate with pupils out of school (or class time).

Hypothesis test revealed a positive correlation between ICT motivation and ICT integration. The relationship was statistically significant. Therefore, it was concluded that ICT motivation has significant positive relationship with ICT integration statistically. This is consistent with the findings of Marcinkiewicz (1996).

5.1.3 Overall Relationship between Teacher Characteristics and ICT Integration

A regression analysis was conducted to establish the overall effect of teacher characteristics on ICT integration. The results revealed that teachers' characteristics affect ICT integration to 44.5%. ANOVA test was carried out to test the significance of the effect of teacher characteristics on ICT integration. The results revealed that teacher characteristic have a statistically significant effect on ICT integration.

5.2 Conclusions

The aim of this study was to establish the relationship between teacher characteristics and ICT integration in Public secondary schools in Nakuru Town Sub-county. Teacher characteristics were studied in terms of attitude and ICT motivation. Two objectives guided the study. Based on results from data analysis and findings in relation to the study objectives the following conclusions were made.

First, the attitude has a statistically significant positive relationship with ICT integration. This implies that schools that have teachers with a positive attitude will succeed in adopting ICT. Secondly, ICT motivation has a relationship with ICT that was statistically significant. Therefore, it was concluded that ICT motivation has a significant positive relationship with ICT integration statistically. This means that teachers who are motivated can effectively integrate ICT in education.

The overall conclusion for this study was that teacher characteristics positively affect ICT integration. Schools with teachers who have these characteristics are therefore likely to experience the successful integration of ICT in their schools. The study has also provided insight into the interrelated nature of teachers' characteristics and the potential level of ICT integration. The

findings suggest that successful ICT integration is related to teacher characteristics.

5.3 Recommendations

The results of this study reveal that teacher characteristics lead to the successful integration of ICT in public secondary schools in Nakuru Town sub-county. The study contributes to the literature about ICT integration in some ways. Firstly, more insight has been obtained in the complex interplay of teacher characteristics affecting their adoption and implementation of educational ICT use. Secondly, ICT policy-makers need to realize that teachers should not be excluded from school policy planning when considering future educational ICT use. Thus, teachers should be involved and be familiar with school level policies. The study thus recommends that policymakers should incorporate the actual use of ICT when developing teacher programs. Finally, considering the influence of the teacher characteristics on classroom use of ICT, teacher professional development should be aware of the direct impact of these variables, especially the role of teacher ICT motivation. Future research should also be carried out in private secondary schools. Other sectors of the economy can also be studied to establish the relationship between workers characteristics and ICT integration.

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