Adoption of Information and Communication Technology in Teaching and Learning in Secondary Schools in Nairobi County, Kenya

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Abstract

Purpose: The purpose of this study was to determine the adoption of information and communication technology (ICT) in teaching and learning in secondary schools in Nairobi County, Kenya. Specifically, the study aimed to evaluate the ICT adoption level, examine the teachers' training in the use of ICT, determine the ICT infrastructural capacity, and find out the teachers' perception of adopting ICT in public secondary schools in Nairobi County.

Methodology: The study adopted a descriptive survey design. The target population comprised 475 teachers and 19 principals in secondary schools in Kasarani and Westland's sub-counties, which were randomly sampled. The sample comprised 164 teachers and 19 principals from 19 secondary schools drawn from the chosen sub-counties. Statistical Package for Social Sciences (SPSS version 25.0) was used to analyze quantitative data. Qualitative data were grouped into themes and analyzed thematically.

Findings: The study found that secondary schools needed to be aware of the advantages of ICT tools to boost learning. Regarding ICT infrastructure, most schools examined had very few computers, which exacerbates the problem considering that most schools in these two sub-counties were county schools. According to the findings, most teachers and students needed easy access to computers for teaching and learning. Furthermore, the study revealed that most secondary school teachers had a positive attitude toward using ICT in teaching and learning. The study found that teachers supported the need for students to use ICT as a tool for practice and learning.

Unique Contribution to Theory, Practice and Policy: The research indicated that appropriate administrative practices by school heads, teacher attitude, and the degree of teachers' ICT knowledge and abilities all significantly impacted the use of ICT in teaching and learning. The study recommends that secondary schools engage in technology education and training, and that the government and other education stakeholders support regular teacher ICT training to modify their view of using ICT tools in secondary school for teaching and learning. This study may be helpful for both the county and national governments in supporting secondary schools in terms of ICT.

Keywords: *Information and Communication Technology, Adoption, Teaching and Learning, Secondary Schools, Nairobi County, Kenya.*

INTRODUCTION

The use of new forms of educational technology has emerged as a widespread movement around the world. Technology has expanded the available learning tools and resources for both students and instructors, making education more accessible to those who are unable to physically attend traditional educational institutions such as schools or colleges. A piece of software known as a Learning Management System (LMS) is one of the technologies that has seen rising demand recently. A learning management system, sometimes known as an LMS, is a web-based platform that is intended to enable and administer online learning. It is a feature-rich application that enables users to administer their courses, provide their content, monitor their progress, generate reports, and evaluate their students.

Information Communication Technology (ICT)

Information Communication Technology (ICT) is the high-tech equipment and services utilized to interact, create, disseminate, store and maintain information (Alghasab, Alfadley & Aladwani, 2020). The adoption of ICTs provides not just laptops and their peripherals but also telecommunication technologies like radios, televisions, and mobile phones. Wasike, Ingendi, and Maiyo's (2020) study has demonstrated the increased use of computers in enhancing learning and student efficacy. Nevertheless, as Nyakowa (2014) points out, the use of personal computers in teaching in undeveloped countries is still in its infancy and is not utilized in some countries owing to inadequate infrastructure and perceived high cost of access. As such, stakeholders need to be assessed about adopting ICT in high school classroom instruction in Kenya.

In Australia, incorporating information technology into nearly all facets of the economy and culture establishes a digital economy that is accountable for causing economic progress and expansion. According to Wanyonyi (2019), Libusi (2020), and McCulloch *et al*. (2018) indicated that in school, there are five levels of technology use: implementation, presentation, drill and exercise, collaboration, and cooperation.

In Kenya, teacher preparation services have failed to identify and implement the most effective strategies for training pre-service teachers to incorporate e-learning into their classes (Obaydullah and Rahim, 2019). With an interactive technology education course, several initiatives have sought to develop teachers' e-learning capability (Kanjam, 2020). According to Kwiek (2020), teachers must complete an ICT course to pass knowledge and skills to their science classroom through e-learning. However, research indicates that the majority of teachers in high schools do not feel sufficiently equipped to efficiently instrument e-learning in their teaching space (for instance, Lawrence & Tar, 2018). Such studies demonstrate the importance of teachers' understanding of ICT use in classrooms and that ICT education does not only focus on how to use innovation but also on how innovation can be used for classroom instruction (Niess, 2005).

Perception toward ICT affects the ability of teachers to embrace the importance of technologies and often influences whether or not teachers incorporate ICT into their classrooms (Lawrence & Tar, 2018). It is clear that if the mindset of teachers towards ICT incorporation in the teaching phase is constructive, they can quickly and happily provide a successful technology adoption process. Moreover, if a teacher's view of ICT is negative, then ICT incorporation cannot be included in the teaching phase. When it comes to information and communications technology usage, Obaydullah and Rahim (2019) found that having a fatalistic attitude toward Integrating technology is an obstacle to using Cloud computing in the instructional step. However,

Omariba (2020) unearthed that a proactive attitude toward Technology adoption is generally regarded as a criterion for adopting integrated teaching and research. Despite this, data on using digitalization in Kenyan secondary classrooms have proven ineffective, necessitating further reform.

Mabeya et al. (2019) researched the variables that influence the incorporation of computer skills into the syllabus of secondary schools in the Uasin Gishu District of Kenya. He was surprised that most schools had not included computer instruction in their curriculum. This stalemate may be attributed to various factors, including a school program already at capacity and a lack of available resources. This results in these schools maintaining the status quo, which means they continue to use conventional ways of teaching that are free of educational technology. As a result, business as usual prevails in these schools. Gender, age, wealth, level of education, and the accessibility of infrastructure in a given region are some of the characteristics that are often identified as impacting the usage of information and communication technologies (ICT). Teachers' attitudes toward technology (Wanjala & Simiyu, 2020) and the training of teachers in schools (Perienen, 2020) have a role in the deployment of information and communication technology at the secondary school level. It's against this background that the current study aims at assessing the acceptance of ICT in teaching and learning; A case study of secondary schools in Nairobi County.

Statement to the Problem

Scholars are exploring the impact of information and communication technology (ICT) on education, but several factors such as lack of government support, technical difficulties, and cost are impeding its classroom adoption. ICT is becoming increasingly important for comprehensive learning outcomes and preparing students for the technological era. However, most Kenyan schools still rely on traditional methods, and the use of ICT by instructors is limited. Although the Kenyan government recognizes the need for an ICT-literate population to reach a knowledge-based market, only a small fraction of instructors uses ICT regularly, and the impact of ICT infrastructure use on teaching and learning is unclear. There is a shortage of computers, educational apps, and teacher training, which hinders complete ICT integration in schools. The researcher intends to investigate the influence of training, infrastructural capability, and perception variables on ICT adoption in Nairobi secondary schools.

LITERATURE REVIEW

Theoretical Foundation

This study utilized the Technology Acceptance Model (TAM) introduced by Ajzen & Fishbein, (1980). The TAM is a philosophy in information systems that describe how people adopt and utilize technology. According to the model, when consumers face a technical problem, a variety of considerations affect their choice as to whether and when they can use the solution in specific. When it comes to perceived usefulness (PU), Fred Davis describes it as the amount whereby a person believes that employing a machine would boost their work productivity. Aside from that, Davis described perception of user friendliness (PEOU) the extent whereby a client anticipates to use a product to be easy (Tahar et al., 2020). It is standard practice to employ acceptability and use of technological as the methodological underpinning for a range of observational studies on consumers' digitalization. It has added to our interpretation of users' acceptance of information systems (IS), and communications. The analysis showed that many studies concentrated on student acceptance in educational institutions (Scherer *et al.,* 2019).

In our model, the PU teachers of e-learning systems are characterized by the perception of degrees of improvement in teaching by the adoption of such a system. The PEU of e-learning systems is the teachers' understanding of how easy it is to implement e-learning systems in their teaching. It is believed that the more teachers who consider the utility of learning systems within an organization, the more favorably they embrace e-learning systems, thus raising their chances of potential use of e-learning systems in schools (Hoq, 2020). Moreover, the acceptance of technology is determined by the behavioral intention to use it. Thus, the implementation of an e-learning system within the institutional context is a positive feature of the intention to embrace the systems.

Some research uses either the TAM or the theory of expected behavior, in order to explain the use of technology in education. While these models indicated perceived utility and ease of use as a vital antecedent to the adoption of technology by consumers, they are not unique to the use of technology by teachers in schools. This research also drew from (Croom & Brandon, 2007) study, which was found to be helpful in identifying the main challenges of implementing ICT strategies in the government sector. Since its conception, the concept has been adopted by researchers to provide empirical proof of the relationship between utility, ease of use and device use.

This theory related to the current study because it highlighted how institutions are embracing technology for a variety of reasons. Such factors may include simplifying learning, centralizing processes, enhancing the quality of service, increasing the quality of service delivery. The benefit of the improved system is that it has facilitated better education and collaboration between. In the classrooms, teachers and learners work together. The introduction and incorporation of ICTs play a crucial role in the process of education and implementation. ICT has come with computer programmes that help to learn and improve efficiency because they simplify and make learning easier for students to learn more and for teachers to want to practice even more. By providing computers to teachers and students in schools who affect their success and by improving the final production, this has made a positive contribution to schools and institutions. Computer application is also important in evaluating the current performance of pre-established performance expectations for students in the classroom as well as for teachers and the school in general.

Empirical Review

This literature review provides a survey of relevant literature in the field of ICT adoption in public secondary schools. The review highlights the mixed adoption of ICT in schools, with a greater use of technology for administration and repetitive tasks than for teaching. Several studies indicate the important role of ICT in school administration, with increased efficiency reported in classroom planning and training, administration, and monitoring. However, the lack of funds to buy and run information and communication technology is a major challenge for many schools. The expertise, trust, and skills of teachers in choosing suitable learning software and utilizing ICT in the lesson rely on their training and professional growth. Several studies indicate the lack of adequate teacher training on ICT adoption in teaching, with most teachers lacking the knowledge and expertise required to effectively incorporate technology into their teaching strategies. To address this gap, researchers recommend the establishment of a comprehensive professional development curriculum for teachers that facilitates their learning from relevant ICT usage for teaching purposes. The current study aims to examine ICT adoption among secondary schools in Nairobi County and fill the research vacuum by using both quantitative and qualitative methodologies. Overall, while the reviewed literature has

focused on the need for training for improved acceptance and adoption of ICT in learning, major gaps remain in the rollout of a robust training program, particularly in the Kenyan context.

Summary of Knowledge Gaps

According to the literature, some countries had increased their efforts to encourage the use of information and communications technology (ICT) in the administration of classrooms. While there has been some study on the degree of electronics implemented in high schools, the bulk of studies have revealed that the degree of Internet acceptability in high schools has been rather low. Nevertheless, multiple reports indicated that ICT implementation and usage in secondary schools has been hampered by difficulties. Most of the findings were primarily based on ICT usage in teaching and management but teachers' impressions of ICT use in these fields must be considered. The literature reviewed made a great contribution to the information based on teachers' experiences of utilizing technology. With most of the of the studies conducted in other countries, there was no research conducted with a focus on the roll-out of ICT programs aiming at building capacities among teachers in secondary schools within Nairobi County. As such, the current study filled the research gap by assessing the adoption of ICT among secondary schools in Nairobi County.

Regarding ICT infrastructural capacity in secondary schools, the reviewed literatures failed to clearly show the level of ICT infrastructure in secondary schools and its significance in promoting ICT learning. The study noted that there was a need to focus on the infrastructural capacity among the secondary schools in Nairobi County, assess the viability of the roll-out of the ICT incorporation programs, and outline the existing gaps in the schools around Nairobi County. For teachers' perceptions of using information and communications technology in public high schools, the most current proof was needed in order to have a positive picture of how Information technology may be used in the management and management of public high schools. With most of the studies highlighting the psychological resistance to change among people working in different sectors, there was need to focus on the psychological impacts of the proposed roll-out of the ICT platform as expressed by the predominant attitudes among the teachers, its impact on the teachers' morale, and the existing gaps that must be fixed to ensure effective rollout.

According to (Matutu & Lelan, 2020), the majority of post-primary institutions, in comparison to public elementary schools, have superior information and communication technology (ICT) infrastructure. On the other hand, the few studies that concentrated on elementary schools (Kenyatta, 2017) show significant contextual differences when compared to the proposed research. The primary school head teachers in Cyprus who participated in the research conducted by (Wanjala & Simiyu, 2020) had access to computers and the internet in their homes, and the majority of them had had extensive ICT training. The research conducted by Sutter and (Kihara, 2019) included participation from educators in Kenya's large and somewhat isolated Baringo County, where some classes are conducted outside of traditional classroom settings. Therefore, it was not reasonable to presume that the results from research like these are applicable to the public secondary schools in Nairobi County, which was why this study was necessary.
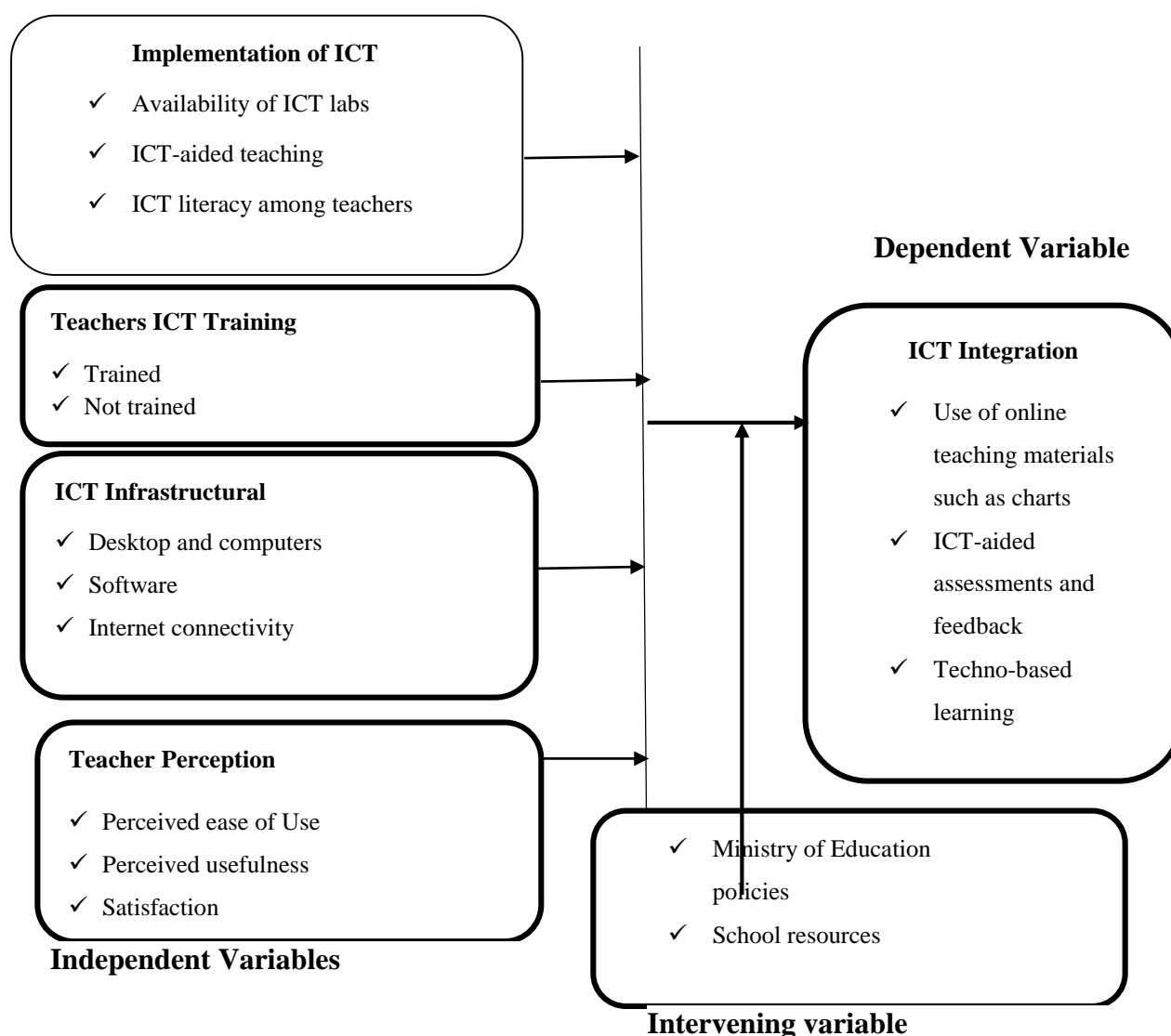
Conceptual Framework

Figure 1: *Conceptual Framework*

METHODOLOGY

This section presents the research design, population/sample and sample technique, data collection methods such as questionnaires, data analysis method, and data presentation methodology. A descriptive survey approach was used, which collected evidence on values, perspectives, beliefs, and motivations. Two sub-counties, Kasarani and Westlands, were selected for the study, with a total target population of 475 teachers and 19 principals. The study used purposive sampling to select principals and stratified random sampling to select teachers. The sample size of teachers was considered adequate based on Mugenda and Mugenda's guidelines. A questionnaire was used to collect data from teachers, while an interview schedule was used for principals. The questionnaire consisted of mostly closed questions, while the interview schedule was developed based on the research issue. Data was collected with a letter of permission from Kenyatta University and a permit from the National Council of Science, Technology, and Innovation.

PRESENTATIONS OF FINDINGS, INTERPRETATION AND DISCUSSION

This chapter presented the study findings and their discussions.

Demographic Characteristics

The demographic features that were considered include the gender of the respondents, age, working experience, teaching subject, existence of computers and the period of existence of computers in schools.

Gender of Respondents

The purpose of the research was to ascertain the gender of those who took part in it. The results are shown in the following figure.

Figure 2*: Gender of Participants*

Figure 2 shows that majority (62%) were male while 38% were female. According to Tannenbaum, Greaves, and Graham (2016), gender and sexual orientation play an essential role in decision-making and the rate of technological, and it is vital to take these factors into consideration while doing research. Changes in technology are molded and organized in accordance with society norms and interactions, which in turn are impacted by technical advancements.

Age of the Respondents

The participants were asked to specify the age group they fell into while responding to the survey. Figure 3 depicts the outcomes of the study.
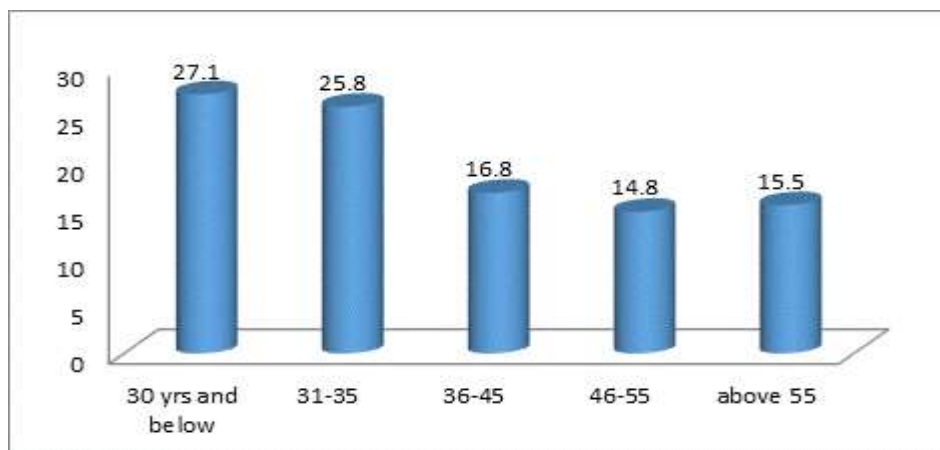

Figure 3: *Age of Participants*

From Figure 3, most of the participants 27.1%) were 30 years and below, 25.8% were between 31- 35 years, 16.8% were 36-45 years, 14.8% were 46-55 years while 15.5% were above 55 years. While Tella (2011), noted that the age of the respondents was applicable to the present study since it is assumed that respondents have adequate knowledge thus can state the position of teacher support in the adoption of ICT in the schools. Muchiri (2008) noted that teachers aged below 35 years are more open to use of technologies as compared to older teachers.

Work Experience

The purpose of the research was to determine the numbers of years the participants had spent working at the institution. The findings are displayed in as shown below.

Table 1: Work Experience

	Frequency	Percent
Less than 5 years	59	38.1%
Between 5 and 9 years	24	15.5%
Between 15 and 19 years	34	21.9%
Between 10 and 14 years	15	9.7%
Over 20 years	12	8%
Total	**155**	**100%**

Table 1 reveals that 38.1 percent had taught for less than 5 years, 15.5 percent had employed for 5-9 years, 21.9 percent had worked for 15-19 years, 8 percent had worked for more than 20 years, and 9.7 percent had taught for between 10 and 14 years, respectively. This suggests that more than 50 per cent of participants had more than 5 years of professional experience and were thus able to offer information on the current level of Technology adoption in secondary schools, as seen in the table above.

Teaching Subject

The researcher was looking for information on the respondents' teaching subjects. The purpose of this study was to assess whether or not the subjects that the instructors teach had any relevance to the use of ICT in the classroom. Table 3 shows the findings of the research.

Table 2: Teaching Subject

Subject	Frequency	Percent
Mathematics	40	25.8%
Science	28	18.1%
Languages	25	16.1%
Humanities	20	12.9%
Technical and Applies sciences	26	16.8%
Computer studies	16	10.3%
Total	**155**	**100%**

Results indicate that 25.8% taught mathematics, 18.1% sciences, 16.8% technical and applied science, 16.1% languages, 12.9% humanities while 10.3% taught computer studies. These findings indicate that most participants teach mathematics. To comprehend the significance of

this research, it is necessary to understand that all of the relevant divisions in secondary school system were covered.

Implementation of Information and Communication Technology

The first objective of the study was to assess the implementation of Information and Communication Technology level among secondary schools in Nairobi County. Participants were asked to score a statement on the Technological Acceptance Level based on the scale of 1(strongly disagree), 2 disagree, 3 represented neutrals, 4 for agree to 5 (strongly agree). The results are summarized in the following section:

Table 3: Implementation of Information and Communication Technology

Statements	1	2	3	4	5	Means	SD
Learners have accessibility to electrical gadgets and/or the web, depending on their age.	(33)21.1%	(34)22.2%	5.6%(7)	38.9%(60)	12.2%(19)	4.2	0.754
Only the instructor has access to a device and/or the web	(16)10.0%	(24)15.6%	(9)5.6%	(86)55.6%	(21)13.3%	4.2	0.533
This academic year, has the school equipped you with a computer or desktop Computer for your personal use?	13.3%(21)	40.0%(62)	(7)4.4%	(34)22.2%	(31)20.0%	4.5	0.954
The usage of ICT in learning and studying has a positive effect on students	(24)15.6%	(33)21.1	(14)8.9%	(60)38.9%	(24)15.6%	4.4	0.854
Learners are exposed to electrical gadgets and/or the online, depending on their age.	(33)21.1%	(34)22.2%	(9)5.6%	(60)38.9%	(19)12.2%	4.1	0.653

The responses to the survey question about the extent of Implementation of Information and Communication Technology in Nairobi County are shown in the column above. According to the results, the mean is 4.2 on the whole scale. This demonstrates that respondents were unanimous in their belief that the majority of teachers felt that schools have easy access to Technology implementation. The average standard deviation for all variables is 0.717, indicating that there is a high variation in terms of participants' respondents. The data reported above demonstrate that schools are familiar with the benefits of using technologies to boost learning. The majority of schools have not provided students with access to laptops, which would allow them to check correspondence and other pertinent information from the institution. This suggests that teachers do not facilitate learning in the use of technologies in education, which has an impact on the overall efficacy of the use of Technologies in schools because some individuals are left out (Baldauf & Stair, 2010). The results are similarly consistent with that of Ngugi (2012), who discovered that the expensive price of laptops and other information and technologies tools was the most significant obstacle to increasing the use of ICT in school administration. Ngugi (2012) observed that administrators and other partners are familiar with

the benefits of utilizing computers and technologies in general in school management, but that a lack of enough funds to acquire and maintain ICT equipment is a barrier to their use.

Use of ICT Tools in Teaching

The study sought to assess participants statement on the adoption of technology based on a level of agreement based on the scale of 1(strongly disagree) to 5 (strongly agree).

Table 4: Use of ICT Tools in Teaching

Statement	1	2	3	4	5	Means	SD
Introduction of internet usage specific software (word processing, worksheets, exhibitions, databases, etc.)	(33)21.1%	(34)22.2%	(7)5.6%	(60)38.9%	(19)12.2%	4.5	*0.643*
Courses in sophisticated software development (specialized Microsoft word, complicated database systems, an online learning, and so on.)	(16)10.0%	(24)15.6%	(9)5.6%	(86)55.6%	(21)13.3%	4.7	*0.843*
Internet communication courses (attempting to create websites/home pages, teleconferencing, and so on).	(5)3.3%	(24)15.6%	(21)12.2%	(57)36.7%	(50)32.2%	4.3	*0.754*
Training with specialized equipment (interactive whiteboard, laptop etc.)	(21)13.3%	(62)40.0%	(3)4.4%	(34)22.2%	(31)20.0%	3.4	*0.644*
Subject-matter instruction in learning frameworks (Lectures, simulation models, and so on.).	(24)15.6%	(33)21.1%	(14)8.9%	(60)38.9%	(24)15.6%	3.6	*0.732*
Multimedia training (utilising moving images, audio, and other associated devices.)	(31)20.0%	(31)20.0%	(9)5.6%	(64)41.1%	(21)13.3%	3.5	*0.643*

According to the results of Table 4, the mean score is 4, indicating that the proportion of respondents agreed with the assertions about computer training for teachers and administrators in schools. The average standard deviation is 0.711, which is higher than 0.5 implying that teachers 'responses varied. According to the statistics, the vast majority of administrators and instructors do not request regular training on using technology in the classrooms. The continuous training of the employees, particularly the teachers, on the use of technology supports their positive attitude toward the integration of technology in the educational environments. Staff members may learn new skills in the usage of technology via training, which prepares them for the implementation of technologies in the classroom (Voogt & Kneezek, 2008). As per Cuddington et al., (2023), appropriate training is a type that one can depend on and with which one feels confident and knowledgeable. It is clear from the data that the staff does not have sufficient training in the usage of technology in educational procedures. The data also reveal that pupils are not completely engaged in computer instruction in their

respective schools, according to the results. The adoption of Technology in the whole learning experience of the institution, as per Totnall et al., (2020), is limited because the learners, who are the main recipients of the procedure, are not active in the process. Budiarto et al., (2021) also stated that when learners do not get education on what is expected of them in terms of computer-assisted learning, the information that instructors desire to convey them would not be delivered successfully to them.

Teacher Training

The study sought to find out the level of teachers training on ICT in teaching in Westlands and Kasarani Sub Counties. The respondents (principals and teachers) were required to use the scale of 1 to 5 to state their level of agreement on the influence of computer training, and the results obtained were as shown in Table 5.

Table 5: Influence a Teacher's Readiness to use ICT in Teaching

	Frequency	*Percent*
Little extent	14	9.03%
Moderate extent	34	21.94%
Great extent	33	21.29%
Very great extent	49	31.61%
Not Responded	25	16.13%
Total	**155**	**100%**

Table 5 shows that 31.61% of the participants noted that teachers have a very great knowledge on ICT, 21.94% stated that teachers have moderate knowledge on ICT while 9.03% Little extent. This suggests that the majority of respondents are in agreement, to a significant degree, with the idea that teacher technical abilities impact the execution of ICT projects.

Specifics ICT Skills that Possessed by Teachers

The purpose of this research was to learn about the different kinds of information and communications technology (ICT) abilities that teachers have acquired in order to determine their degree of expertise in the use of computer software in the classroom setting of secondary schools.

Table 6: Variety of ICT Training that Teachers

Skill proficiency	Frequency	Percentage
Word processing	47	30%
Databases(access)	19	12%
Spreadsheet(excel)	23	15%
Graphics	11	7%
PowerPoint	12	8%
Internet	16	10%
Email	28	18%
Total	**155**	**100%**

From Table 6 it was discovered that thirty percent of teachers, or 47, are capable of using word processing to an acceptable and very good degree. The majority of teachers indicated that having word-processing abilities allows them to access and make soft copies for pupils to read. In addition to this, it was discovered that the majority of educators have sufficient knowledge of databases administration (access), which enabled them to employ the electronic filing technique. It was discovered that other instructors, numbering 23, had a very high level of proficiency with spreadsheet (excel) software. They did clarify that the computations had been carried out quite successfully by making effective use of the spreadsheet abilities where necessary. According to the visuals, the results showed that just a small fraction (7% of respondents) were able to utilize it. The vast majority of pupils lacked the ability to utilize visuals. Also the majority of educators Other 12 people (8% of the total) were unable to use PowerPoint well, which caused problems with the presentation of their work. However, 16 people (10%) were able to utilize the internet extremely effectively, and 28 people (18%) were also proficient in the use of email. It was consequently inferred that even though instructors have been taught in the majority of ICT abilities, there is space for growth.

Effectiveness of ICT Teachers Training

The aim of the research was to determine, with the help of the educators who took part in the research, whether or not the training was successful.
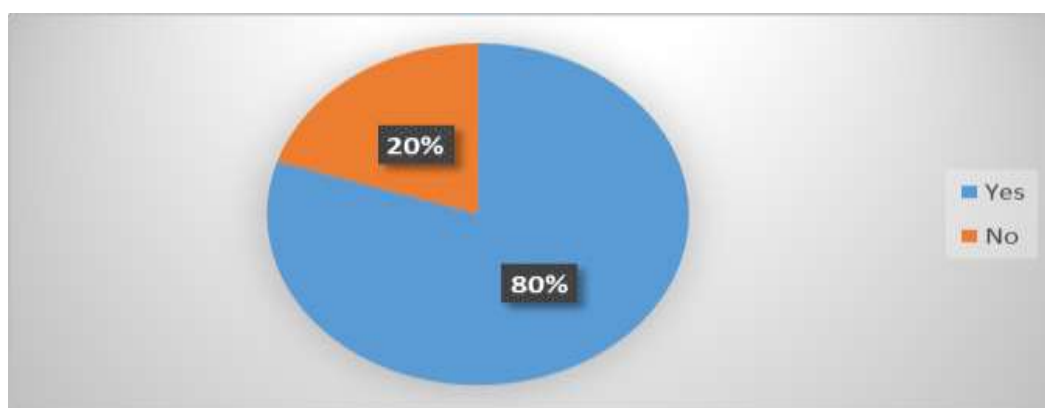

Figure 4: Effectiveness of ICT Teachers Training

According to the findings of the study, the (80%) vast majority of educators evaluated the information and communication technology (ICT) training that they received positively, as indicated by eighty percent of the respondents, while just twenty percent of educators evaluated the ICT training negatively.

In this sense, principals were asked to indicate the effectiveness of training on the adoption of ICT in secondary schools.

" There is little doubt that teachers will continue to be the gatekeepers of students' access to university options afforded by technology. Educators need more than technical training in the use of technology to keep up. Professional development in the application of these abilities must be pursued by teachers as well, in order to enhance teaching and learning. When it comes to helping instructors learn how to effectively integrate technology into their classrooms, traditional one-time instructor training courses have fallen short. New paradigm is evolving that substitutes training with a lifetime of professional development and teaching improvement. There are many components to this approach: teacher preparation programs, classroom support, and on-going technical and pedagogical assistance.

Teacher professional development should cover the types of knowledge needed for teaching and should include the development of appropriate knowledge management methods (Degirmenci, 2018). One way to determine if knowledge management is successful is whether educators can easily access research-based information to improve their practice. This is particularly vital in areas of fast development, such as educational ICT applications and the utilization of networks and other ICT advances to promote the flow of information, which is critical in improving teaching capacities.

ICT Infrastructure

The goal of this study was to establish the ICT infrastructure capacities of secondary schools in the Nairobi County region. Amongst many other things, the emergence of information and communication technology (ICT) into education is directly depends on a combination of requisite Information and communication technologies, which include the availability of processors as well as electricity and internet connectivity as well as radio equipment, televisions and video cameras, among many other things.

Availability of the Necessary ICT Infrastructure in Schools

The researcher was looking for information on the amount of Information technology infrastructural development that were accessible to him. Specifically, it was intended to assist the investigator in determining the degree to which Information technology may be incorporated into learning and teaching. Figure 5 depicts the results of the study.
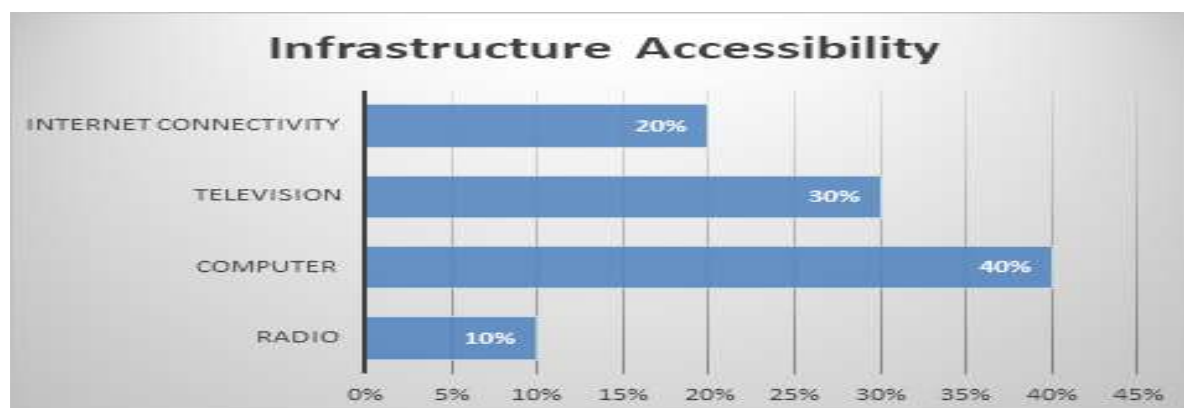

Figure 5: Accessibility of ICT Facilities Schools

Figure 5 demonstrated that majority (40%) of participants noted that their schools are equipped with computers, 30% said Television, 20% internet connectivity while 10% indicted that the schools have radio. Based on the results, computers are the commonly accessible information and communications technology (ICT) resource in classrooms. One probable reason for this is because computers are seen as the most essential information and communication technology facility and are thus highly prized.

Distribution of Computers in Schools

It was discovered that the majority of secondary schools were equipped with laptops. Schools also featured various types of Infrastructural development, such as radios, TVs, and Media players, that were largely utilised for fun in the classroom (Matutu & Lelan,

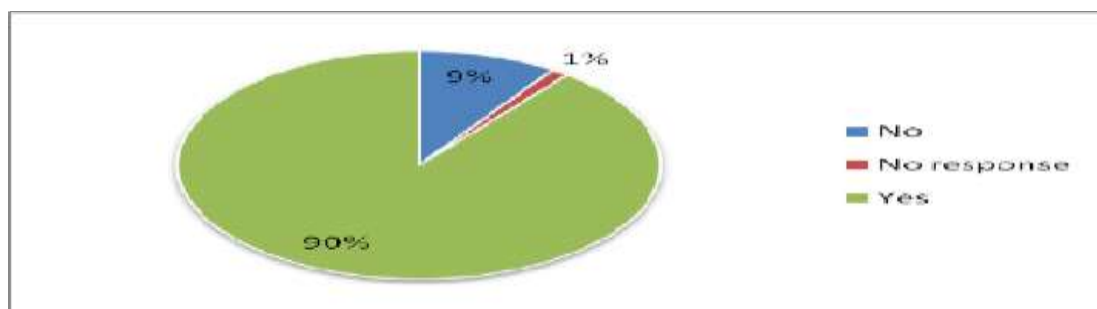2020) School districts with computers are shown in percentages in Figure 6.

Figure 6: Schools with Computers

A diagram showing how respondents were distributed among the network of processors available at the chosen universities is presented in Figure 6. The data above illustrates that computers were available in 90 percent of the county's institutions, while just 9 percent were without them.

Number of Computers in Schools

The sought to assess participant's views on the number of computers used in schools and the results were as presented below;
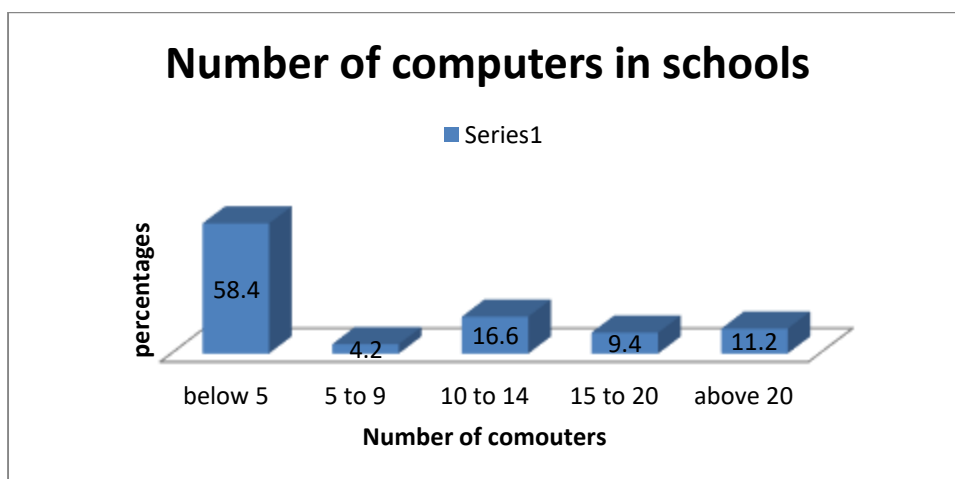

Figure 7: *Number of Computers in Schools*

Figure 7 depicts the perspectives of participants on the number of computers available in schools. According to the findings of the study, 58.40 percent of the schools evaluated had less than 5 laptop stations. The overwhelming of county schools examined (58.40 percent) fall into the category of having less than 5 laptops, which exacerbates the problem considering that county schools account for the vast majority of schools in the nation. One explanation for this might be because students at d national levels pay large tuition, that might be used to acquire these ICT services, however the county did not have the necessary cash to purchase the ICT infrastructure. With such a huge number of learners registered in elementary level, the data centres available were incapable to be leveraged effectively to include Technology into teaching and learning. The government's strategy of subsidizing secondary education has resulted in this situation being created.

Location of the Computers in Schools

The position of the monitors in the school impacts whether or not they are available used in education and learning. Figure 8 depicts where machines are located in schools.
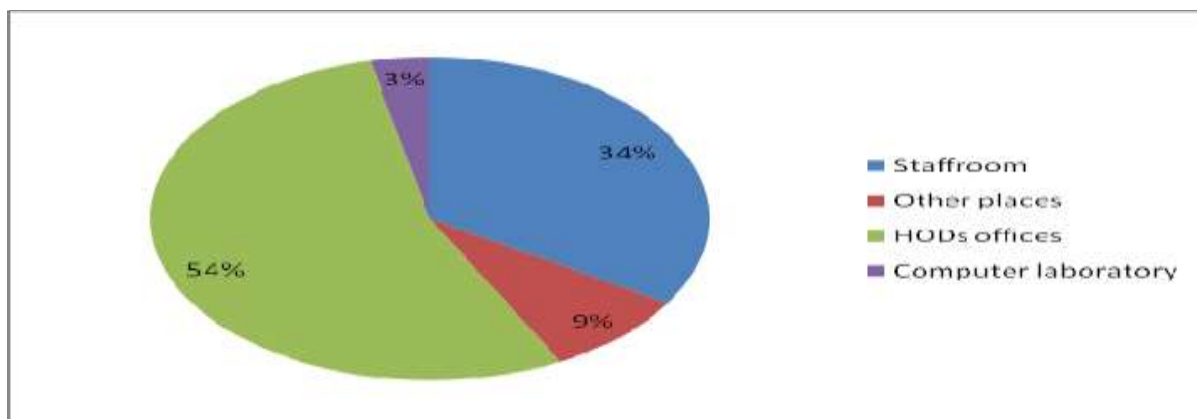

Figure 8*: Location of Computers in Schools*

The study revealed that the majority of computers in schools are located in the offices of high school administrators (54.0 percent), according to the results as presented in Figure 8. This meant that the majority of instructors and pupils would have difficulty gaining access to the servers. According to the assessment instrument, the majority of day schools have fewer than five laptops, that are mostly utilized for administrative tasks in the school building (Chilufya, 2022). In this case, even delivering the work produced by the professors to the students could only be accomplished via the use of paper records (Atta & Bonyah, 2023).

Internet Connection in School

The researcher was interested in finding out which schools were connected to the web. In the end, the results were as depicted in Figure 9.
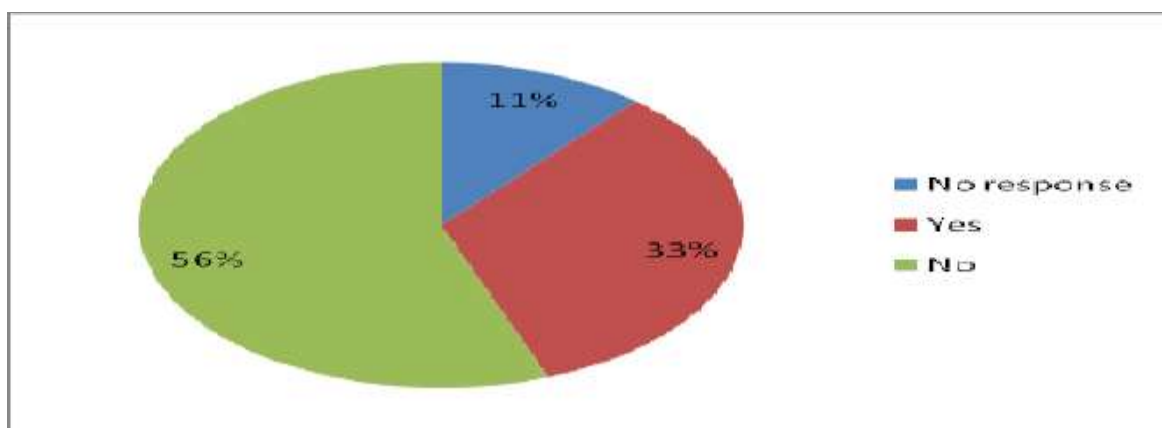

Figure 9: Internet Connection in Schools

Figure 9 indicates represents participant's distribution based on internet connectivity in schools. According to the statistics, 56.0 percent of the schools did not have connection speeds, but 33.0 percent of the schools that did have web access in their building. According to the data, only a small number of schools have access to the internet. One possible explanation is the high cost of construction and repair associated with Internet connection services. In addition, since the majority of social secondary schools in the

county are low-income institutions, these programs may be unavailable because of the institution's financial situation. Teachers were also requested to provide information on the mode of connectivity in their schools and results were as presented in the Table below.

Table 7: *Internet Connection in School*

Internet connection	Frequency	Percent
WIFI	62	68.9%
Prepaid modem	4	4.4%

According to Table 7, 68.9 percent of internet access were made over WIFI, with just 4.4 percent made through a prepaid modem connection. This implies that not only is broadband internet inconsistent, but it is also very costly due to the fact that prepay moderns are offered by telecommunication companies, whose charges are quite high. The researcher was interested in finding out what instructors thought about various assertions made about ICT infrastructure in multiple schools.

ICT Infrastructural Capacity in Secondary Schools

The study sought to assess participant's level of agreement on infrastructure in the implementation of technologies in teaching and learning. This was followed structured questions whereby participants were asked to indicate their level of agreement based on the scale of 1(strongly disagree) to 5 (strongly agree).

Table 8: ICT Infrastructural Capacity in Secondary Schools

Statement	1	2	3	4	5	Means	SD
insufficient number of computers	19 (12.2%)	(20)13%	(6)4%	41%(64)	(47)30%	4.6	0.859
Inadequate internet access	(5)3.5%	(14)9.3%	(20)15.9%	50.3%(78)	(34)22%	3.4	0.653
Inadequate computers connectivity	(5)3.0%	(11)7%	(34)22%	45%(70)	(36)23%	3.7	0.435
Inadequate or intermittent electricity supply	(6)4%	(7)4.3%	(28)18%	42%(65)	(48)31%	4.3	0.934
High hardware and development costs	(8)5%	(16)10%	(28)18%	22%(34)	(70)45%	4.0	0.353
Inadequate selection of relevant applications	(19)12%	(12)8%	(26)17%	33%(51)	(47)30%	3.8	0.234
Computers are arranged in a structural manner.	(3)2.0%	(11)7%	(29)18.4%	32.2%(50)	(64)41%	4.4	0.153
Computers are extremely old and sluggish.	(4)2.9%	(12)8%	(27)17.5%	(63)40.7%	(48)30.9%	3.9	0.253

The Table 8 presents respondent's views on ICT capacity in Secondary Schools. The average mean is 4 indicating that most teachers strongly agreed that there is enough ICT infrastructure. The table reveals that most participants agreed that there is insufficient number of computers, inadequate or intermittent electricity supply, high hardware and development costs, computers are arranged in a structural manner with means (4.6,4.3,4.0, and 4.4) respectively. According to the findings, the majority of students have the necessary Digital instruments for classroom

instruction, making the process of forming or enhancing the utilization of Technology in teaching less burdensome. According to Masegenya and Mwila, (2023), with all high school's computers, maintaining and analyzing school staff data can be simple and secure. The internet is very useful for gaining further information, doing research on new topics, and learning how things are done in the real world (Masegenya and Mwila, (2023). The survey discovered that many schools did not have an internet service, which might restrict the degree to which in both education and learning, electronics is utilized because individuals have restricted access to scientific platforms.

One of the major impediments to the adoption and acceptance of ICT usage in teaching and learning in schools is a lack of cash to obtain ICT instruments (Usman & Madudili, 2020). It was discovered throughout the study that the preponderance of teachers believed that one way to enhance Technology acceptance in teacher education is to start seeking financial aid for the purchase of Information and communication technologies. This finding was consistent with the literature. Improvements in school admins' guidance on using information and communications technology (ICT) led to an increase in the application of ICT in school settings, per the results of the study. The findings are consistent with those of (Usman & Madudili, 2020), who discovered that when supervisors or school administrators set the instance by using Information and communication technology in conducting their management tasks in the classroom, the other employees were inspired to follow suit, resulting in an overall implementation of ICT integration and having to learn. The results demonstrate that schools may embrace ICT as a standard teaching instrument by including employees in decision-making processes. This is consistent with the results of (Ombui, 2013), who discovered that principals who include their personnel in school decision-making processes regarding the use of Information technology end up gaining greater collaboration from the employees, which improves the usage of Technology in school administration. The outcomes of (Phiri, 2022) research revealed that student participation in ICT improves ICT adoption in classroom instruction. As per Phiri, (2022), pupils are the main factors of a school successful completion of a project, and their engagement in ICT signifies strong adoption of ICT usage in teaching and learning.

Teachers' Perception on the Adoption of ICT

The fourth purpose of the research was to determine how instructors felt about the use of information and communications technology (ICT) in government secondary schools in Nairobi County, and the findings are presented in the table;

Table 9: Teachers' Perception on the Adoption of ICT

Statement	1	2	3	4	5	*M*	SD
Students focus further on their studies	(8)5%	(14)9%	(60)39%	(39)25%	(34)22%	3.3	0.643
Students feel like independent in their learning	(6)4%	(12)8%	(47)30%	(62)40%	(43)28%	3.7	0.543
Students comprehend more clearly what they read	(12)8%	(8)5%	(25)16%	(50)32%	(60)39%	4.0	0.943
Learners know more clearly what they've learned	(12)8%	(17)11.1%	(29)18.7%	(45)29.3%	(51)32.9%	4.3	0.754
ICT promotes collective work for students.	(0)0.0%	(9)5.9%	(35)22.4%	(47)30.5%	(64)41.2%	4.4	0.653
ICT strengthens the class environment (students more interested, less disturbing)	(0)0.0%	(14)8.4%	(36)23.4%	(52)33.7%	(53)34.5%	4.1	0.630

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Table 9 demonstrates that the average mean is 4.0 and standard deviation is 0.694 meaning that most participants agreed on statement on teachers' perception on the Adoption of ICT. The standard deviation is 0.694, indicating that there is a great deal of variety in the opinions of the respondents on the deployment and Implementation. Also discovered were that learners experience more independent in their classroom instruction, that learners understand what they have learned more certainly, that it encourages collaborative work for applicants, and that Information and communication technology reinforces the classroom environment (students more interested, less disturbing with means of (4.0) 4.4 and (4.1).

Table 10: Teachers' Perception on Usage of Technology in the Classroom

Statement	1	2	3	4	5	Mean	Standard deviation
Learners should be using ICT to do drills and learn.	(0)0.0%	(24)15.3%	(29)19%	(35)22.3%	(67)43.4%	4.4	0.76
Obtain facts	(0)0.0%	(7)4.7%	(27)17.3%	(42)27.4%	(78)50.6%	4.5	0.89
Collaborate on your work.	(0)0.0%	(0)0.0%	(28)18%	(51)32.8%	(76)49.2%	3.6	0.73
The usage of ICT in teaching and studying has a positive effect on pupils.	3.8%(6)	(28)17.9%	(31)19.9%	(54)34.9%	(36)23.5%	3.5	0.72
Proficiency in a variety of skills (Knowing how to study, social abilities, and so on are all important.)	(0)0.0%	(0.4)0.3%	(43)28%	(51)32.8%	(59)38.9%	3.9	0.82
The use of information and communication technology (ICT) in teaching and learning is essential for helping learners to operate and perform in the twenty-first millennium.	(0)0.0%	(0)0.0%	(45)29%	(50)32%	(61)39.4%	4.0	0.34
To completely use ICT for education and learning, fundamental changes in schools are needed.	0.0%	(18)11.7%	(9)6%	(36)23%	(92)59.3%	4.2	0.85

Table 10 indicate that the average mean is 3.9 and standard deviation of 0.71, indicating that most participants agreed to teacher's perception on the adoption of information technology in classroom. The findings also reveal that teachers agreed that learners should be using ICT to do drills and learn, and the usage of ICT in teaching and studying is critical for preparing students to function and work in the twenty-first century with means of (4.4,4.5,4.0 and 4.2) respectively. Studies have confirmed that through adoption of ICT, the teachers are able to monitors the impacts of these platforms on the learning process, asses the student perception and their general impact on the teacher's morale (Ogundile et al., 2019). The results indicate that very few educators utilize Information and communication technology in their instructional and educational material features, which is consistent with the findings of Ismail

(2010), who discovered that teachers were needed to adopt ICT in teaching and learning as long as the necessary tools were supplied as the primary educational tools. The data also suggest that the majority of instructors feel that incorporating ICT facilities would enhance the classroom atmosphere (Obaydullah & Rahim, 2019). A study by (Tmison & Taylor, 2017) discovered that the conveniences connected with ICT tools increased instructors' effectiveness in the classroom. As per Ngugi (2010), the usage of technology is connected with excellent teacher performance, as seen by students' better performance.

As a result, the data show that the majority of teachers would favor increasing inclusion of Learning and teaching in schools, implying that computer usage has the ability to improve educational objectives. According to (Philiphs & Sianjina, 2013), owing to technological advancements, school instructors should be able to access and utilize Information and communication technology because this is the only method they can inspire and guide students in adopting new technology. Implementation of Electronic in schools necessitates mainly worried instructors who are willing to set a pattern for other school personnel (Howei *et al,* 2015). As a result, for the efficient integration of Technology in school administration, teachers must be at the forefront of utilizing ICT in teaching. In summary, Arkorful et al., (2021) observes that ICT technologies have clearly influenced learning and research in the area of education. A substantial amount of research has shown the advantages to academic achievement (Amin et al., 2022).

SUMMARY, CONCLUSIONS AND RECOMMENDATION

Summary

On the first objective, the implementation of Information and Communication Technology level among secondary schools in Nairobi County. The respondents agreed that Introduction of internet usage specific software (word processing, worksheets, exhibitions, databases, etc.) has helped in learning and teaching. respondents were unanimous in their belief that the majority of teachers felt that schools have easy access to Technology implementation. Information and communications technology (ICT) makes it possible to use cutting-edge educational resources and creative methods to learning. This not only encourages greater student engagement in group work but also helps students grow their technical knowledge simultaneously. The usage of information and communication technologies (ICTs) is also a significant factor that contributes to the growth of perception.

The second objective, significance of teachers training on the adoption Information and Communication Technology among public secondary schools in Nairobi County. Majority 31.61% of the participants noted that teachers have a very great knowledge on ICT, 21.94% stated that teachers have moderate knowledge on ICT while 9.03% Little extent. This seems to indicate that the majority of respondents are in agreement, to a substantial degree, with the view that the technical skills of teachers have an influence on the implementation of ICT projects. Moreover, 30% of teachers are capable of using word processing to an acceptable and very good degree.

The third objective was to determine Information and Communication Technology infrastructural ability in secondary schools in Nairobi County. Researcher founded that majority (40%) of participants noted that their schools are equipped with computers, Television, internet connectivity and radio. The findings show that 58.40 percent of the schools evaluated had less than 5 laptop stations. On the location of computers, the majority of computers in schools are located in the offices of high school administrators (54.0 percent),

according to the results. According to the statistics, 56.0% of the schools did not have connection speeds, but 33.0 percent of the schools that did have web access in their building. According to the data, only a small number of schools have access to the internet.

The last objective was on teacher's attitude in adoption of Information and Communication Technology in secondary schools in Nairobi County. Researcher founded that most participants agreed on statement on teachers' perception on the Adoption of ICT. Also learners experience more independent in their classroom instruction, that learners understand what they have learned more certainly, that it encourages collaborative work for applicants, and that Information and communication technology reinforces the classroom environment. On the Usage of Technology in the Classroom, most participants agreed to teacher's perception on the adoption of information technology in classroom.

Conclusions

On the adoption of ICT in learning and teaching, the study concluded that the adoption of information and communication technology in Nairobi County's secondary schools Participants agreed that the introduction of internet-specific software (word processing, worksheets, exhibits, databases, and so on) had aided in learning and teaching. The majority of instructors, according to respondents, have simple access to technology deployment in their classrooms. Information and communications technology (ICT) also enables the use of cutting-edge instructional resources and novel ways to learning, which encourages increased student engagement in group projects and the concurrent development of technical knowledge. Furthermore, the usage of ICTs substantially aids the development of discernment. According to the findings of the survey, the majority of instructors believe that schools have easy access to technology deployment.

On the significance of teachers training on the adoption Information and Communication Technology among public secondary schools in Nairobi County, the study concluded that most teachers are trained on ICT skills. It is reasonable to draw the conclusion that in addition to receiving training in education, instructors have also received instruction in computer technology and have obtained at least a computer certificate. The vast majority of responders have knowledge of word processing software, internet, and email. The respondents' abilities in database management, graphics, PowerPoint, simulation, and file navigation were all below average. The schools provide students with access to computers that have internet connectivity. The majority of those who answered the survey make frequent use of computers. In most schools, there is a single computer lab that has more than 16 different machines. As a result of the fact that more than five pupils use each laptop in the majority of the schools, the computers are insufficient. Desktop computers and projectors are the most typical kind of ICT equipment found in educational institutions. In addition to that, mobile phones are used. The vast majority of those who responded had experience that is less than five years old.

On the Information and Communication Technology infrastructural ability in secondary schools in Nairobi County, the study concluded that schools had a reasonable number of desktop computers for teachers and students to utilize. The fact that the schools in question did not have access to desktop computers led the researchers to conclude that there was an extremely little chance of increasing the level of ICT awareness among the teaching staff and student body. In terms of ICT facilities, the number of schools selected fall into the category of having less than five computers, which is exacerbated by the fact that the vast majority of schools in these two sub-counties are county schools, as previously stated. Furthermore, the

data of ICT infrastructure indicated that the majority of instructors and students were unable to quickly utilize technology in classrooms for the goals of teaching process.

On evaluate teacher's attitude in adoption of Information and Communication Technology in secondary schools in Nairobi County, the study concluded that most teachers had a positive perception on the adoption the use of information and communications technology (ICT) in secondary education. The researcher also found that teachers agreed that learners should be using ICT to do drills and learn. The usage of ICT in teaching and studying is critical for preparing students to function and work in the twenty-first century.

Recommendations

The following recommendations are made by the research in order to maximize maximal utilization of information and communication technology (ICT) in classroom instruction in government high schools in Kasarani and Westland sub-counties.

    i.   For the first objective, it is recommended that it is necessary to enhance the classroom environment in order to accommodate Information technology. Infrastructure, like as labs, should be best prepared than they are at the moment in order to support a greater number of students.

    ii.   For the second objective, it is recommended that there is need for intensive teacher training in the use and application of the ICT platforms in classroom teaching and general research.

    iii.   In objective three, it is recommended that it is important to increase the amount of money allocated to the Ministry of Education in order to help in improving the ability of the schools to roll out the ICT hire additional instructors.

    iv.   For objective four, there is need build teacher's capacity to make them build a positive attitude towards the use and appreciate ICT as one of the most efficient teaching and learning tool.

REFERENCES

Amin, I., Yousaf, A., Walia, S., & Bashir, M. (2022). What shapes E-Learning effectiveness among tourism education students? An empirical assessment during COVID19. *Journal of Hospitality, Leisure, Sport & Tourism Education*, *30*, 100337.

Arkorful, V., Barfi, K. A., & Aboagye, I. K. (2021). Integration of information and communication technology in teaching: Initial perspectives of senior high school teachers in Ghana. *Education and Information Technologies*, *26*, 3771-3787.

Atta, S. A., & Bonyah, E. (2023). Designing a flipped classroom instruction to improve plane geometry learning among pre-service teachers in Ghana. *Contemporary Mathematics and Science Education*, *4*(1), ep23004.

Baldauf, K., & Stair, R. (2010). *Succeeding with technology*. Cengage Learning.

Budiarto, M. K., Rejekiningsih, T., & Sudiyanto, S. (2021). Implementation of computer-assisted learning in high school: Teachers and students' perspective. *International Journal of Education and Management Engineering*, *11*(4), 26-34.

Chilufya, M. M. (2022). *Understanding the sources, application and enhancement of information communication and technology (ICT) application in the management of selected secondary schools in Lusaka district* (Doctoral dissertation, The University of Zambia).

Cuddington, K., Abbott, K. C., Adler, F. R., Aydeniz, M., Dale, R., Gross, L. J., ... & White, E. R. (2023). Challenges and opportunities to build quantitative self-confidence in biologists. *BioScience*, biad015.

Degirmenci, Y. (2018). Use of Geographic Information Systems (GIS) in Geography Lessons According to Teachers' Opinion. *World Journal on Educational Technology: Current Issues*, *10*(3), 186-196.

Esfijani, A., & Zamani, B. E. (2020). Factors influencing teachers' utilisation of ICT: The role of in-service training courses and access. *Research in Learning Technology*, *28*.

Hoq, M. Z. (2020). E-Learning during the period of pandemic (COVID-19) in the kingdom of Saudi Arabia: an empirical study. *American Journal of Educational Research*, *8*(7), 457-464.

Kabwika, R. (2019). Adoption Of Information And Communication Technology In Improving Teaching And Learning In Marist Secondary Schools In The Democratic Republic Of Congo (Doctoral dissertation).

Kanjam, S. (2020). *The role of visionary leadership, faculty development and infrastructure in technology adoption: a case study of private secondary schools in the North West region of Cameroon* (Doctoral dissertation, Notre Dame University-Louaize).

Masegenya, S., & Mwila, P. (2023). Information and Communication Technology Usage in Record Keeping in Public Secondary Schools in Ilemela Municipality, Tanzania. *International Journal of Information Systems and Informatics*, *4*(1), 1-17.

Muchiri K.A (2008). The use of ICT in enhancing teaching and learning in public primary teacher training colleges in Kenya MED project submitted at University of Nairobi.

Mugenda O.M and Mugenda A.G (2003) Research methods: Quantitative and Qualitative approaches: Nairobi Acts Press

Mukenya, M., Wanjala, M., & Shikuku, B. (2020). Mathematics Teachers' knowledge And Skills for ICT Adoption in Instruction in Secondary Schools in Bungoma County, Kenya. *European Journal of Education Studies*.

Ngugi, M., (2012). Influence of selected factors on the implementation of information and communication technology policy in public secondary schools in Naivasha Sub-county, Kenya. *International Journal of Education and Development using ICT*, *13*(2).

Obaydullah, A. K. M., & Rahim, M. A. (2019). Use of ICT for Primary science Teaching and Learning at the Primary Schools in Bangladesh. *International Journal of Advance Research and Innovative Ideas in Education*, *5*(1), 642-651.

Ogundile, O. P., Bishop, S. A., Okagbue, H. I., Ogunniyi, P. O., & Olanrewaju, A. M. (2019). Factors influencing ICT adoption in some selected secondary schools in Ogun State, Nigeria. *International Journal of Emerging Technologies in Learning (iJET)*, *14*(10), 62-74.

Phiri, C. (2022). *Experiences of teachers in teaching computer studies as a compulsory subject in secondary schools in Kitwe district, Zambia* (Doctoral dissertation, The University of Zambia).

Tahar, A. Riyadh, H. A., Sofyani, H., & Purnomo, W. E. (2020). Perceived Ease Of Use, Perceived Usefulness, Perceived Security And Intention To Use E-Filing: The Role Of Technology Readiness. *The Journal of Asian Finance, Economics, and Business*, *7*(9), 537-547.

Tatnall, A. (2020). Birth of Information Systems Curricula in Victoria in Colleges of Advanced Education and Universities. *Encyclopedia of Education and Information Technologies*, 228-234.

Scherer, R. Siddiq, F. & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13-35.

Usman, Y. D., & Madudili, G. C. (2020). Assessment of the impact of computer assisted instruction on teaching and learning in Nigeria: A theoretical viewpoint. *International Journal of Education and Development using Information and Communication Technology*, *16*(2), 259-271.

Voogt, J., & Knezek, G. (Eds.). (2008). *International handbook of information technology in primary and secondary education* (Vol. 20). Springer Science & Business Media.