

**INFLUENCE OF INFORMATION COMMUNICATION  
AND TECHNOLOGY INTEGRATION PROJECTS ON THE  
PERFORMANCE OF PUBLIC SECONDARY SCHOOLS IN  
KCSE IN KIAMBU COUNTY, KENYA**

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**A Research Project Report Submitted in Partial Fulfilment of the Requirements for  
the Award of the Degree of Master of Arts in Project Planning and Management of  
the University of Nairobi**

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## DECLARATION

This research project report is my original work and has not been presented to any other university for any award.

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## **DEDICATION**

This research project report is dedicated to my beloved parents Mr. Joseph Ndung'u Wambu and Mrs. Bernadette Wambui Ndung'u, and to my siblings; Eliud, Nelly, Catherine and Lilian for their support and sacrifice to see me through my education.

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## TABLE OF CONTENT

<b>DECLARATION.....</b>	<b>i</b>
<b>DEDICATION.....</b>	<b>ii</b>
<b>ACKNOWLEDGEMENT.....</b>	<b>iii</b>
<b>TABLE OF CONTENT.....</b>	<b>iv</b>
<b>LIST OF TABLES.....</b>	<b>ix</b>
<b>LIST OF FIGURES.....</b>	<b>x</b>
<b>ABBREVIATIONS AND ACRONYMS.....</b>	<b>xi</b>
<b>ABSTRACT.....</b>	<b>xii</b>
<b>CHAPTER ONE: INTRODUCTION.....</b>	<b>1</b>
1.1 Background of the Study.....	1
1.2 Statement of the Problem.....	3
1.3 Purpose of the Study.....	4
1.4 Objectives of the Study.....	4
1.5 Research Questions.....	5
1.6 Hypothesis of the Study.....	5
1.7 Significance of the Study.....	6
1.8 Delimitations of the Study.....	6
1.9 Limitations of the Study.....	6
1.10 Assumptions of the Study.....	7
1.11 Definition of Significant Terms Used in the Study.....	7
1.12 Organization of the Study.....	8
<b>CHAPTER TWO: LITERATURE REVIEW.....</b>	<b>9</b>
2.1 Introduction.....	9

2.2 Performance of Public Secondary School in KCSE .....	9
2.3 ICT Infrastructure and Performance of Public Secondary Schools in KCSE.....	11
2.4 Development of Digital Content and Performance of Public Secondary Schools in KCSE .....	13
2.5 Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE .....	14
2.6 Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE .....	15
2.7 School Culture Performance of Public Secondary Schools in KCSE.....	17
2. 8 Theoretical Framework.....	18
2.8.1 Diffusion of Innovations .....	18
2.8.2 Technology Acceptance Model .....	18
2.9 Conceptual Framework.....	19
2.10 Knowledge Gap .....	21
2.11 Summary of Literature Review.....	25
<b>CHAPTER THREE: RESEARCH METHODOLOGY .....</b>	<b>26</b>
3.1 Introduction.....	26
3.2 Research Design.....	26
3.3 Target Population.....	26
Table 3.1: Target Population.....	27
3.4 Sample Size and Sampling Procedure .....	27
3.4.1 Sample Size Determination.....	27
3.4.2 Sampling Procedure .....	28
Table 3.2: Sample Size Determination .....	29
3.5 Research Instruments .....	29
3.5.1 Pilot Testing .....	29
3.5.2 Validity of the Research Instruments.....	30

3.5.3 Reliability of the Research Instruments .....	30
3.6 Data Collection Procedure .....	30
3.7 Data Analysis Techniques.....	31
3.8 Operationalization of Variables .....	32
Table 3.3: Operationalization of Variables .....	32
3.9 Ethical Considerations .....	34
<b>CHAPTER FOUR: DATA ANALYSIS, PRESENTATION AND INTEPRETATION .35</b>	
4.1 Introduction.....	35
4.2 Questionnaire Return Rate .....	35
Table 4.1: Questionnaire Return Rate.....	35
4.3 Reliability Coefficients .....	35
Table 4.2: Reliability Coefficients of the variables .....	36
4.4 Demographic Characteristics of the Respondents .....	36
4.4.1 Distribution of Respondents by Gender.....	36
Table 4.3: Distribution of Respondents by Gender .....	36
4.4.2 Distribution of Respondents by Highest Level of Education .....	37
Table 4.4: Distribution of Respondents by highest level of Education .....	37
4.4.3 Distribution of Respondents by Years of Experience in ICT .....	38
Table 4.5: Number of Years of experience in ICT .....	38
4.5 ICT Infrastructure and Performance of Public Secondary Schools in KCSE.....	38
Table 4.6: ICT Infrastructure and Performance of Public Secondary Schools in KCSE ....	39
4.6 Development of Digital Content and Performance of Public Secondary Schools in KCSE .....	40
Table 4.7: Development of Digital Content and Performance of Public Secondary Schools in KCSE .....	41
4.7 Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE .....	42

Table 4.8: Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE .....	43
4.8 Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE .....	44
Table 4.9: Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE .....	44
4.9 Performance of Public Secondary Schools in KCSE.....	46
Table 4.10: Performance of Public Secondary Schools.....	46
4.10 Correlation Analysis .....	47
Table 4.11: Correlation between the Explanatory variables and Performance of Public Secondary Schools in KCSE.....	48
4.11 Regression Analysis.....	49
Table 4.12: Model Summary .....	49
4.11.1 ANOVA Results .....	49
Table 4.13: Table 4 ANOVA Test.....	50
4.11.2 Regression Coefficient.....	50
Table 4.14: Regression coefficient .....	51
<b>CHAPTER FIVE: SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS .....</b>	<b>53</b>
5.1 Introduction.....	53
5.2 Summary of Findings.....	53
5.2.1 ICT infrastructure on performance of public secondary schools in KCSE .....	53
5.2.2 Development of digital content on Performance of Public Secondary Schools in KCSE .....	53
5.2.3 Capacity building of teachers on Performance of Public Secondary Schools in KCSE .....	53
5.2.4 Procurement of ICT devices on Performance of Public Secondary Schools in KCSE .....	54



5.3 Discussions of the findings .....	54
5.3.1 ICT infrastructure on performance of public secondary schools in KCSE .....	54
5.3.2 Development of digital content on Performance of Public Secondary Schools in KCSE .....	54
5.3.3 Capacity building of teachers on Performance of Public Secondary Schools in KCSE .....	55
5.3.4 Procurement of ICT devices on Performance of Public Secondary Schools in KCSE .....	55
5.4 Conclusion of the Findings .....	55
5.5 Recommendations.....	56
5.6 Suggestions for Further Research .....	56
<b>REFERENCES.....</b>	<b>57</b>
<b>APPENDICES .....</b>	<b>64</b>
Appendix I: Letter of Transmittal .....	64
Appendix II: Questionnaire.....	65

## LIST OF TABLES

Table 2.0-1: Knowledge Gap Matrix .....	<b>Error! Bookmark not defined.</b>
Table 3.1: Target Population.....	27
Table 3.2: Sample Size Determination .....	29
Table 3.3: Operationalization of Variables .....	<b>Error! Bookmark not defined.</b>
Table 4.1: Questionnaire Return Rate.....	35
Table 4.2: Reliability Coefficients of the variables .....	36
Table 4.3: Distribution of Respondents by Gender .....	36
Table 4.4: Distribution of Respondents by highest level of Education .....	37
Table 4.5: Number of Years of experience in ICT .....	38
Table 4.6: ICT Infrastructure and Performance of Public Secondary Schools in KCSE .....	39
Table 4.7: Development of Digital Content and Performance of Public Secondary Schools in KCSE .....	41
Table 4.8: Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE .....	43
Table 4.9: Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE .....	44
Table 4.10: Performance of Public Secondary Schools.....	46
Table 4.11: Correlation between the Explanatory variables and Performance of Public Secondary Schools in KCSE.....	48
Table 4.12: Model Summary .....	49
Table 4.13: Table 4 ANOVA Test.....	50
Table 4.14: Regression coefficient .....	51

## LIST OF FIGURES

Figure 1: Conceptual Framework on Influence of Information, Communication and Technology Integration Projects on Performance of Public Secondary Schools in KCSE in Kiambu County, Kenya. ....	20
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## **ABBREVIATIONS AND ACRONYMS**

<b>CEP:</b>	Character Education Partnership
<b>DCS:</b>	Digital Content Servers
<b>DLP:</b>	Digital Literacy Programme
<b>ICT:</b>	Information Communication Technology
<b>KCSE:</b>	Kenya Certificate of Secondary Education
<b>KICD:</b>	Kenya Institute of Curriculum Development
<b>MOEST:</b>	Ministry of Education, Science and Technology
<b>TAM:</b>	Technology Acceptance Model

## ABSTRACT

ICT can be used to access and promote equity in education through providing educational opportunities to a larger number of people of all ages that include the underserved or the traditionally unserved for example those in rural and remote areas and people with disabilities. It can be used to enhance the quality of learning and teaching through providing access to a greater variety of the current educational resources and enabling the participatory pedagogies. Kiambu County has a high secondary school learner population in the country, however, the levels performance of most of these schools remains significantly low. The purpose of this study was to investigate the influence of ICT integration projects on performance in public secondary schools in KCSE in Kiambu County Kenya. The study sought to investigate the following objectives: to assess the influence of ICT infrastructure on performance of public secondary schools in KCSE in Kiambu County, Kenya; to examine the influence of development of digital content on performance of public secondary schools in KCSE in Kiambu County, Kenya; to determine the influence of capacity building of teachers on performance of public secondary schools in KCSE in Kiambu County, Kenya; to examine the influence of procurement of ICT devices on performance of public secondary schools in KCSE in Kiambu County, Kenya. The study adopted a descriptive survey research design. The target population of the study of 4403 was drawn from the head teachers, ICT head of departments and teachers from Kiambu County. A sample size of 351 participants was extrapolated from the target population using FISHERS formula from which a proportionate stratified sampling was used to obtain a sample for each stratum. Data was collected using questionnaires. The data collection instrument was tested using 35 questionnaires that were administered to headteachers, ICT head of departments and teachers in Nairobi County which had similar characteristics with the study area. The Cronbach's alpha coefficient of 0.762 was obtained through the test-retest technique to check reliability of the research instruments. Descriptive statistics in the form of frequencies, percentages, mean and standard deviation was used to analyze the data. The analysed data using SPSS was presented in the form of tables. Pearson correlation coefficient was used to determine the relationship between the variables in the study. The study revealed that there was a positive moderate correlation between ICT infrastructure and performance of public secondary schools in KCSE ( $r=0.552$ ,  $p=0.000$ ), development of digital content and performance of public secondary schools in KCSE demonstrated a positive weak correlation ( $r=0.436$ ,  $p=0.000$ ), capacity building for teachers and performance of public secondary schools in KCSE indicated a positive weak correlation ( $r=0.232$ ,  $p=0.000$ ) and procurement of ICT devices and performance of public secondary schools in KCSE indicated a positive moderate correlation ( $r=0.502$ ,  $p=0.000$ ). The study concluded that that the independent variables under the study influence the performance of public secondary schools in KCSE. The study recommends that public secondary schools should be adequately equipped with more ICT infrastructure, digitize classroom content, increase capacity development for ICT and allocate more funds to procure ICT devices to improve KCSE performance. The study further suggests that research should be carried out to investigate the influence of ICT integration projects on the new curriculum goals of public secondary schools in KCSE.



## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background of the Study

Global organizations and interest groups have called for learners to acquire the required skills and knowledge in the performance and engagement of knowledge based and digital societies (Aesaert, Vanderlinde, Tondeur and Van Braak, 2013). These 21st century competencies include: critical thinking, collaboration, problem solving, creativity and communication (Abbott, 2010). Selwyn (2007) states that learners have a great ability to develop these 21st century skills when they are presented with learning opportunities by utilizing Information, Communication and Technology (ICT). The development of the information economy throughout the world has pushed nations to organize instructive long lasting and quality learning and organizing it for helpful open doors for every individual. ICT in instruction within learning institutions has a significant impact through the training framework, upgrading the learning standards and paving way for new arrangements of abilities through understudies with developing countries. On a global level, integration of ICT is no longer limited to developing countries as the use of computers in schools for communication, instruction sharing and information acquisition has become increasingly common.

In Africa, ICT integration has been a rare experience in the education system for most of the schools. Countries within the sub-Saharan Africa region show that the quality of education is negatively impacted by politics, low economic growth cause by high debt levels and ethnic conflicts. The resultant effect has been the slow developments in education in these countries forcing school to use the traditional learning methods. This has had a negative effect on the growth in education. Due to this reason, developing countries have initiated efforts that embrace technology as a development agent. This is because ICT in developed countries has positive effect on development and hence this is necessary for future development plans in African countries. The Government of Ghana is commitment to the rapid deployment, use and exploitation of ICTs in the educational sector and other sectors. Therefore, the country developed a National ICT Policy and Plan Development Committee in 2002 aimed at developing ICT policy known as the Information and Communication Technology for Accelerated Development (Buabeng-Andoh and Issifu, 2014). According to Tedla (2012), ICT gives educational openings and environmental readiness for learning guidelines.

There has been an increasing development in the emerging technologies and the uses of ICT in education have also attracted the attention of various educational authorities in Kenya (Evoch, 2010). Ministry of Education in Kenya states that digital technologies are to be deployed widely for learning and teaching both primary and secondary schools (Kenya and Kenya, 2008). Education has been forwarded as the central sector to pursue and attain the set goals of the ICT policy as the other sectors will also benefit from this approach. Therefore, the national authorities in Kenya in their ICT Strategy for Education and Training (2012), proposed that the integration of ICT in learning institutions should be aimed at learning and teaching for the purposes of improved performance and educational outcomes, developing the diverse skills for a knowledge-based economy and industrialization. Their main goal is to ensure that all levels within the education sector are ICT literate. The integration of technology in secondary education is important across the diverse contexts of Kenya, as a mere 32% of all school-age learners are attending secondary school (Kenya and Kenya, 2008). Coupled with challenges such as the lack of infrastructure, connectivity, electricity and finances, and capacity building, ICT integration in secondary schools remains restricted in some parts of the country despite the growth in the number of computers within schools in Kenya (Ogembo, Ngugi and Pelowski, 2012).

Learners' performance in national examinations is of significance importance in today's society as it is used for learners' admission and career placement in middle level colleges and universities in most countries all over the world. There have been considerable investments towards learning and teaching methods that have necessitated the need to measure the impact of ICT on learners' performance as a return on investment in education (Nketiah-Amponsah et al. 2017). The standard approaches on performance are focused on achievement the contents in the curricular, how the learners understand the course contents and obtain their marks. In Kenya, secondary schools assess their learners' GPA at the end of four years using the Kenya Certificate of Secondary Education (KCSE) administered by the Kenya National Examinations Council (KNEC). Another measure of performance includes the transition to tertiary education.

ICT assumes a more prominent part in learning and the perceived education outcomes such as the performance of learners. Up until the 2000s, Kenya did not have a policy on the integration of ICT in schools. A national policy on ICT was adopted in 2006 after numerous efforts to put one in place. The main purpose of this objective was to offer affordable, reliable, efficient and accessible ICT services (MOEST, 2005). The Information Technology (IT) section of the



objectives regarding the use of ICT in schools' colleges, universities were well stated. E-Learning was a significant aspect of the report. The Ministry of Education allocated the task of developing the education module to the Kenya Institute of Curriculum Development (KICD). The integration of ICT has also been highlighted in the Jubilee Government Manifesto under the Digital Literacy Programme (DLP) which is aimed at aligning ICT integration into learning and teaching for Grade One pupils.

The main objectives of DLP includes improving ICT infrastructure, developing digital content, capacity building and the procurement of ICT devices (Ministry of Education, 2016). With these objectives in place, it is necessary to investigate the viability of the project's expected outcomes through measuring learners' performance as reflected in their Kenya Certificate of Secondary Education (KCSE) within secondary schools. In reference to the input-output ratio as suggested by Aristovnik, (2012) on the impact of ICT on education performance and its efficiency in selected EU and OECD countries, this study will measure performance based on the output factors to the learner's performance in KCSE and transition to tertiary level learning. This means that by focusing on the key objectives for the DLP which also act as the independent variables in this research, as the input factors, the measure of performance, an output factor will be measured by the KCSE performance trends and the transition to tertiary education in public secondary schools in Kiambu County.

## **1.2 Statement of the Problem**

Considering the significant investments associated with ICT infrastructure development, development of digital content, capacity building of teachers and procurement of ICT devices in addition to the mandate to improve the quality of education and raise the achievements of all learners, public secondary schools in Kenya and key stakeholders in secondary education find themselves at a critical juncture within the history of education reform in this country (Weston and Bain, 2010). Therefore, there is one important question that confronts public secondary schools and key stakeholders in secondary education today in regards to these reform efforts. This is whether there can be any justification on the use of limited resources to sustain the ICT integration in secondary schools that has limited evidence to suggest the overall effectiveness on the performance of learners (James, 2010).

Researchers have maintained an interest in making an effective prediction of learners' performance at school. This prediction and explanation of performance and the examination of the influence of ICT integration on learner performance is important in different levels of

education. Studies have showed that prior academic achievement is an important predictor of performance at other levels of education. Similarly, cognitive ability was found as the strongest predictor of academic achievement (Bridgeman et al. 2000). Gachinu (2014) investigated the influence of ICT integration on performance in mathematics within public secondary schools. The study found that in schools where ICT was integrated in mathematics classes that were learner-centered, these learners performed much better when compared to the teacher-led method. However, some studies have confirmed that the correlation between cognitive ability and academic achievement tends to decline as learners' progress in the education system.

Public secondary schools in Kiambu County have consistently been known to produce the top students in the KCSE examination which means that most of them are able to transition to tertiary institutions. In 2017, the following schools from Kiambu County were featured in the top 100 performing schools in KCSE: Alliance High School, Alliance Girls' High School, Loreto High School Limuru, Maryhill Girls High School, Limuru Girls' School, Highlands High School in Limuru and St.Francis Girls High School in Mang'u. These are only eight schools among the 277 public secondary schools in the entire county. This means that it is important for schools to take measures that will improve the performance of the county in KCSE. For the last two decades, the link between the use of computers and learners' performance has been a point of focus for most researchers. Areti and Makridou-Bousiou (2006) found that the use of ICT helps learners with their learning by improving their communication between them and the instructors. On the other hand, Leuven et al. (2004) stated that there is no evidence for a relationship between the increased use of ICT and learners' performance, in fact, they find a consistently negative and marginally significant relationship between ICT use and some measures of learner performance. Based on all these, the researcher seeks to investigate the influence of ICT integration on performance of public secondary schools in KCSE in Kiambu County, Kenya.

### **1.3 Purpose of the Study**

The purpose of this study was to investigate the influence of information communication and technology integration projects on performance of public secondary schools in KCSE in Kiambu County, Kenya.

### **1.4 Objectives of the Study**

The study was guided by the following objectives;

- i. To assess the extent to which ICT infrastructure influences performance of public secondary schools in KCSE in Kiambu County, Kenya.
- ii. To examine the influence of development of digital content on performance of public secondary schools in KCSE in Kiambu County, Kenya.
- iii. To determine the extent to which capacity building for teachers influences performance of public secondary schools in KCSE in Kiambu County, Kenya
- iv. To examine the influence of procurement of ICT devices on performance of public secondary schools in KCSE in Kiambu County, Kenya.

### **1.5 Research Questions**

The study answered the following research questions;

- i. To what extent does ICT infrastructure influences performance of public secondary schools in KCSE in Kiambu County, Kenya?
- ii. How does development of digital content influence performance of public secondary schools in KCSE in Kiambu County, Kenya?
- iii. To what extent does capacity building for teachers influence performance of public secondary schools in KCSE in Kiambu County, Kenya?
- iv. How does the procurement of ICT devices influence performance of public secondary schools in KCSE in Kiambu County, Kenya?

### **1.6 Hypothesis of the Study**

The study tested the following hypothesis;

1. **H<sub>1</sub>**: There is a significant relationship between ICT infrastructure and performance of public secondary schools in KCSE in Kiambu County, Kenya.
2. **H<sub>1</sub>**: There is a significant relationship between digital content and performance of public secondary schools in KCSE in Kiambu County, Kenya.
3. **H<sub>1</sub>**: There is a significant relationship between capacity building for teacher and performance of public secondary schools in KCSE in Kiambu County, Kenya.
4. **H<sub>1</sub>**: There is a significant relationship between procurement of ICT devices and performance of public secondary schools in KCSE in Kiambu County, Kenya.

### **1.7 Significance of the Study**

The findings of this study may be of significance to the Ministry of Education especially in determining whether the project has been able to meet the main objectives as well as impact on learners' performances as reflected in KCSE results and transition rates. This would enable them to further provide the resources and infrastructure that is necessary for the implementation of ICT in learning.

One crucial role of policy makers in ICT integration projects is assisting in the process of monitoring and evaluating of the current policies for primary schools. The direct involvement in managing how schools integrate sustainable ICT projects is important in helping them understand the influence on performance for each public secondary school in Kiambu County to come up with sustainable corrective measures. By continuously involving the KICD, this project will enhance the curriculum through integrating sustainable ICT projects to provide quality education in formulating policies with partnerships with education providers and stakeholders.

Theoretically, this study is expected to contribute to the pool of knowledge in ICT integration projects in public secondary schools as well as provide a base on which other researchers can develop their studies.

### **1.8 Delimitations of the Study**

The research study considered Public Secondary Schools in Kiambu County. This was due to the management structure of Public Secondary Schools that is structured centrally with the Ministry of Education guidelines that enhance the similarity and uniformity in the way Public Secondary Schools are managed. There are numerous aspects that influence the ICT integration projects in public secondary schools, but this study was delimited to four variables: ICT infrastructure, development of digital content, capacity building of the teachers, and procurement of ICT devices.

### **1.9 Limitations of the Study**

This study was limited to Public Secondary Schools in Kiambu County, due to time and accessibility. However, the researcher committed to setting aside the required time during the development of this research and data analysis. Prior arrangements were made to remedy any inconveniences throughout the research period.

### **1.10 Assumptions of the Study**

This study assumed that the participating public secondary schools had fully integrated ICT in their learning. This study assumed that the ICT infrastructure was currently in use for the purposes of teaching and learning.

### **1.11 Definition of Significant Terms Used in the Study**

**Capacity Building of the Teachers-** Refers to the development of teaching skills and techniques focused on enhancing skills and knowledge of teachers and school heads using ICT as a tool and Computer Assisted Instruction for improving teaching and learning strategies.

**Development of Digital Content-** This is the identification of approved educational content materials to be digitized and availed in a secure platform for learners. The content comes in the form of text, audio and video files, animation, graphics and images.

**ICT Infrastructure-** These are all the equipment necessary to deliver the digital content including teacher digital device, learner's digital device, projector, DLP content servers (DCS), digital wireless router, power supply for grid or solar power, device storage and charging and special needs specific devices.

**Information Communication and Technology Integration-** This is entrenching ICT in teaching and learning process, equipping public secondary schools with appropriate ICT infrastructure to support teaching and learning, to develop capacity of teachers, education managers and other stakeholders with necessary ICT skills.

**Performance of Public Secondary Schools-** Refers to the learners' level of achievements and attainment of knowledge and skills compared to others. It also shows the position of schools in terms of ranking from national examinations such as KCSE results and transition to tertiary education.

**Procurement of ICT Devices-** The supply of the three different classes of devices that include a teachers' digital device, a learners' digital device and a special needs education learner digital device, these are also accompanied by the installation of server routers and projectors to the public secondary schools in Kenya.

## **1.12 Organization of the Study**

The study will be organized into five chapters. Chapter one will include background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations of the study, delimitations of the study, assumptions of the study and the definition of significant terms. Chapter two will consist of the related literature review to the study: empirical and theoretical review, the conceptual framework and the knowledge gap. Chapter three presented the methodology that was adopted for the study that includes research design, target population, sample size and sampling procedure, data collection instruments, data collection procedure, data analysis, ethical considerations and the operationalization of variables. Chapter four will look into the data analysis, data presentation, interpretation and discussion. Chapter five will present the summary of findings, discussion, conclusions, recommendations and suggestions for further research.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 Introduction**

This chapter is a review of literature that is related to the study based on both the thematic and sub thematic areas that are in line of the study objectives. The main thematic areas are focused on ICT integration in secondary school education and the learner's performance in Kiambu County. The sub thematic areas are ICT infrastructure, development of digital content, capacity building of the teachers and procurement of ICT devices. Further discussions are on the empirical studies that explain these relationships and the theoretical and conceptual frameworks that the study is based on and the summary of literature.

#### **2.2 Performance of Public Secondary School in KCSE**

The requisite for the development of ICTs has become a global resolution and is a subject of high significance to humanity (Olaofe, 2005). Technologies have become a primary focus in contemporary society. Whether it is communication through telephones, receiving and sending emails, accessing banking services, watching news on television or working in an office, one of these requires the use of ICTs. The Association of African Universities (2000) defines information technology as a shorthand for software, computer, networks, satellite links and any related systems that make it possible for people to create, access, exchange, use and analyze data, knowledge and information in ways that were previously considered imaginable. The existence and fast development of ICTs has been able to transform human society from the age of information technology to the knowledge age (Emmons, 2000). The purpose of ICTs in education requires certain competences as explained by Kirschner and Davis (2003). These include the personal use of ICT in instruction, mastering a range of educational paradigms that use ICTs for instruction, use of ICTs as mind tools, use of ICTs as tools of teaching, use of ICT in assessment and understanding ICT policy dimensions for the purposes of teaching and learning.

Literature indicates that ICT has a significant role in performance. For instance, Oliver (2002) notes that ICT encourages learners to take responsibility for their own learning. In other words, the traditional transmissivity model in teaching and learning process is inapplicable in the ICT model. The learner-centered model, which is encouraged in today's teaching and learning, is accelerated by ICT as learners can make their own notes, write their assignments and make

private studies by using computers and internet. In addition, using ICT in educational settings is a catalyst between the learner and the teacher as it supports independent learning which in turn improves the learner's performance.

The availability and use of ICT can help learners in the exploitation of numerous possibilities in the acquisition of information for learning purposes and for communication (Geoffrey, 2010). The availability of visual digital technology that includes moving images, simulation and animation as highlighted by Bennet and Dunne (1997) involves the learners and also reinforces their understanding of concepts. In addition to this, the use of ICT encourages using a student-focused model in which the learners work together, make decisions and actively participate in learning (Geoffrey, 2010). The goal of this research is to contribute to the research findings on the influence of ICT integration on performance of public secondary schools by providing an empirical test in the different opinions using KCSE results, attendance rates and transition to tertiary education.

The access to modern technology such as computers, networking, peripherals and resources offer teachers and learners a diverse range of technology that is important in teaching and learning in the 21st century. ICT mainly investigates an input of the learner's progress in learning so as to produce better learning output. The access and availability of ICT resources can enhance learning depending less on the teacher quality as information is made available for the learner as they want and need it (Mbwesa, 2002). The integration of ICT can transmit knowledge in a positive manner (Bennet and Dunne, 1997). Therefore, from the transmission of knowledge in secondary schools contributes to learning and ease of comprehension hence an improvement in the learner's performance.

The use and accessibility of ICT allows learners to investigate the real world thoroughly. This is because they can access information easily outside the classroom setting and they can also use these tools to interpret and analyse the information. Information is often accessed through an online system or using systems that support data logging. These technologies allow learners to receive feedback, build new knowledge and transfer what they learn from a school setting to a non-school setting (Committee on Developments in the Science of Learning, 2000). Due to logistical constraints in the past, secondary schools have found it difficult to cover extensive learning material and this can now be addressed with ICT. When learners in secondary schools can deepen and broaden learning, they are able to understand concepts better and hence this has a significant impact on their KCSE grades.



To have affective integration of ICT, secondary schools would call for the entire learning center to be networked to access multimedia and learning-rich resources through the Internet. Therefore, computer laboratories need to have enough computers that can allow the access to both learners and staff. There is a wide range of peripheral that is considered in the integration of ICT, these include the remote working devices, video conferencing and the integration of the curriculum. Group presentations in small and large groups also support learning as learners can share ideas, interact with each other and technology. However, Mwiluli (2018) states that despite the desire to achieve the above in institutions, some of the challenges that affect integration of ICT include limited infrastructure, and the access to ICT resources. This, according to academic and commercial developers has affected education when compared to other learning institutions that have these facilities, hence the performance in these schools continues to show minimal improvements (Mwiluli, 2018).

### **2.3 ICT Infrastructure and Performance of Public Secondary Schools in KCSE**

In a study conducted in Michigan, the access to laptops and the degree of how they were used proved to have a strong predictor on the improved test scores on state standardized tests (Sauers and Mcleod, 2012). Another study in California Harvest Park Middle school concluded higher test scores both in the short term and the several years. The availability of laptops in was found to have a significantly positive impact on test scores after an assessment of programs in America (Holcomb, 2009). State standardized tests have been used for over 30 years with the intention to hold schools accountable and to assess learner achievements. However, Mouza (2008) states that it can be challenging to couple the laptop programs with standardized tests scores especially in the first year. Even though the availability of laptops in schools holds a potential in the accomplishment of educational assessment goals, the inclusion of the 21<sup>st</sup> century skills has been limited (Canuel, 2006). These skills include collaboration and problem-solving and abstract reasoning. Karimi (2011) found a strong relationship between the availability of ICT infrastructure with learners' performance in KCSE with these schools performing better in their exams than those without.

Hyland et al. (2014) used combined data from government programs that provided broadband access to primary schools in Ireland. Their study concluded that internet use in the class had a significantly higher average on Mathematics and reading scores on standardized tests. Similarly, in another study, Grimes et al. (2017) assessed the effects of fiber broadband on the school's academic performance schools. It was concluded that fiber broadband increases the

schools' passing rates in standardized assessments by one percentage point. However, a research conducted in Portugal showing the effect of broadband use in schools on learner performance in terms of national exams for learners concluded otherwise. They found that the higher use of broadband was detrimental on learner scores. Therefore, they concluded that the introduction of broadband is not enough to improve the learners' performance in KCSE and its deployment should be accompanied by complementary measures that are aimed at supporting the use of technology in productive ways.

The learning environment with the rampant of emergence of the use of information technologies for education requires that good facilities are a precondition for learner learning provided they are supporting the learners' academic performance (Mononen-Aaltonen, 2008). Several studies show that the school systems in urban and high-poverty regions are affected by poor infrastructure such as power supply threatening the safety and usability of ICT devices. The concept of a physical learning environment in regards to physical structures necessary for ICT integration includes spaces, tools and equipment within the schools. To successfully integrate ICTs in schools, access to good quality electricity is a basic provision (Mingaine, 2013). Many parts of Kenya, especially the rural schools are not connected to the national electricity grid and even for the parts where there is electricity; the supply is marked by frequent power blackouts. This has a consequential effect on the learner's performance in KCSE as they are not able to use the devices for learning as expected in their curriculum.

Children with special needs have learning disabilities that make it harder for them to learn or access education than most children in primary schools. These children may need extra or different help from that which is given to other children (Westwood, 2003). The introduction of ICT in secondary school education therefore plays a major part in shaping the skills and knowledge of these children with learning disabilities. Keiyoro (2010) argues that the use of ICT in teaching and learning reduces the amount of time on direct instruction of learners by teachers and in doing so, it gives teachers an opportunity to help learners who have special learning needs. In a study by Fakrudeen et al. (2017), a skill test was conducted as a part of the study and it was found that hearing impaired learners aged 12 and 14 were able to do simple arithmetic but they were unable to perform complex arithmetic. Further, the study tested mathematical and computer skills and revealed that the learners were able to solve all problems supplied by research for subjects taught through braille for visually impaired learners. Special

children were found to have improved test scores when using assistive technology and ICT resources (Fakrudeen et al. 2017).

## **2.4 Development of Digital Content and Performance of Public Secondary Schools in KCSE**

Scholars under the Scholars Strategy Network (2014) assessed the impact of digital content and resources on learner performances. Their studies concluded that there was an enormous variability in how digital instructional programs were rolled out, accessed and supported. The quality of educational programming using these resources depends on more factors than the software and technologies purchased by the state. Scholars Strategy Network (2014) concluded that from general analyses, digital content does regularly add value to instruction even when the technologies are working well and readily accessible. The study was based on large samples of learner test scores which showed that digital content does not impact on the learners' performances. Educators should therefore spend a lot of instructional time and substantial resources on the deployment of these content so that they are able to get the right training to support improved academic performance in KCSE (The Kenya Education Staff Institute KESI, 2011)

Computer aided instruction focuses on the use of software programs on laptops in the classroom. A summary of early education literature by Liao (1992) suggested positive effects of the use of software programs on standardized tests. Additionally, in China, Mo et al (2014) conducted a randomized experiment in 72 rural schools that supplemented math instruction with computer games. The study found that the math scores increased with a 0.17 standard deviation for learners. An evaluation of the "Fast for Word" program by Rouse and Krueger (2004) showed that there were gains in language and reading skills, however, there were no positive effects on standardized tests that are correlated with language and reading skills. Their argument was that the use of computer aided instruction may not be considered as effective as the use of traditional classroom instruction. Otiang'a, Ayere and Rabari (2019) also found that ICT educational software and resources in delivering the curriculum alone many not be a determining factor in the influence of improved performance in KCSE.

Zwart et al. (2017) conducted a study seeking to investigate the effects of digital learning material on learners' performance in Mathematics in vocational education. Through assessing instructional clips, structuring of content, online guidance and collaboration tools, they concluded that learners performed better due to the use of instructional clips and the structure

of the content. Digital learning material offers a wide range of opportunities in education that cannot be achieved by the traditional face-to-face methods of learning (Kalyuga and Liu, 2015). However, despite these advantages related to digital learning material, it may not guarantee sufficient benefits on the learners' performances. Noroozi, et al. (2012) therefore suggests that it should be accompanied with the appropriate instructional approaches to facilitate the learning of concepts and improved learner performance.

Practices that favor the knowledge transmission in the classroom such as the sharing of files with learners or the use of web-sites during lessons are a crucial dimension in understanding how ICT integration influences learner performance. Otiang'a, Ayere and Rabari (2019) conducted a research on the influence of ICT on performance among public schools in Kisumu. Their findings concluded that when learning takes place using communication systems, this influences the learners' performance in KCSE. Digital tools can be used in supporting the delivery of information and the concepts in an effective and efficient manner mainly through projecting images and texts. Balanskat et al (2006) found that using computer generated content to share information during a lesson provides support for the teachers through planning their lessons effectively and making lessons more attractive for learners and positively impacting the learners' performances. Higgins et al. (2007) found that interactive whiteboards have a positive effect on the on the learner motivation levels with visual appeals helping learners remember content often and hence a record on improved learner performances.

## **2.5 Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE**

Learners' performance remains at the core of national stakeholder forums and debates in the education implementation process and planning in Kenya. Through a collaboration between Kenya and Japan, the establishment of Strengthening of Mathematics and Science in Secondary Education was aimed at tackling the poor performance in mathematics and science subjects. The project was aimed at providing in-service education and training for teachers and improving the learners' performances through innovative learning and teaching in secondary schools. In a joint report, the project was closed in 2013 and it had achieved the set objectives (JICA, 2014). The report further notes that most of the teachers, school principals and education managers benefited from capacity development through in-service education and training. However, despite the interventions on teacher capacity development, the learner performance

in KCSE remained inconsistent and in some cases was poor for most of the learners which implied that some gaps were yet to be addressed.

To realize learner performance gains, teachers need to have strong content knowledge, pedagogical knowledge and the skills to teach others (Darling-Hammond, et al 2005). These skills can only be gained through pre-service teacher education. Through pre-service education for ICT integration, it is important that teachers can understand the learners and their development, general abilities for explaining, observing and organizing ideas, and making judgements in the learner needs in each context. Amadalo, Sulungai and Toili and (2012) conducted a research on the teacher related factors that influence ICT integration in teaching mathematics in secondary schools. Their research concluded that most teachers in Kenya did not attend in-service training and this affected ICT learning and consequently affecting KCSE performance negatively. Several researchers have studied the learners' performance in terms of factors affecting learners' performance in single or several subjects. The results conclude that the role of pre-service teacher education in a project like ICT integration in determining the learners' performance is significant (OECD, 2009; Cooter. 2003).

The personal willingness and capacity building for school heads to integrate ICT in administration is critical for schools developing technologically (Gess-Newsome, 2003). If well trained and adopted effectively, ICT skills in teaching and administration practices can result to high performance standard in schools. In a research investigating teacher-based factors on the integration of ICT in secondary schools in Vihiga Sub-County, Kadiri (2015) found that head teachers supported ICT integration through expressing that teachers needed extra time to prepare and present. This as a considerable variable in ICT integration showed that the participation of head teachers in ICT integration was able to improve KCSE performance (Kadiri, 2015)

## **2.6 Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE**

Government intervention and participation through the allocation of financial resources is necessary for the integration of ICT in education. Gui et al. (2018) looked at the role of the government in Italy through which classes were given additional resources to purchase the ICT devices. From the evaluation results, there was a very modest increase in literacy and learner performances, with these increased being confined to children from low-educated parents and the lower part of the scores distribution. Further, there was a qualitative analysis by an external classroom observer who reports that the degree of cooperation between the learners in the

classes with ICT devices is much stronger than the traditional classes. Therefore, the funds allocated to think classes. In Kenya, there was a comparison in the KCSE performance of NEPAD (New Partnership for Africa's Development) schools and the non-NEPAD Schools by Ayere, Odera and Agak (2010). Their study found that the government's ability to embrace the project showed better performance in Computer Studies for NEPAD schools although there was no significant difference in the overall KCSE performance.

Additional funding for computers and software supports the existing ICT infrastructure and improves the availability and access to ICT in schools. Leuven et al. (2007) focused on the implementation of a policy in the Netherlands that was aimed at providing additional funding for software and computers to schools where more than 70% of the learners were disadvantaged. From this research, the authors found that the computer subsidy was not used to invest in extra computers or replace the old ones but it was used to buy new software or invest in internet connection. The authors further focused on the threshold of the share of disadvantaged learners that was set by the policy to identify the effect on the achievement of the learners. They concluded that despite the learners spending more time on computers at school, their test scores were either insignificantly or negatively affected.

Penszko and Zielonka conducted a post-evaluation study of the digital school project implemented in Poland in the academic year 2012/2013 in schools. Through this comprehensive public intervention, funds were allocated for the procurement of ICT equipment, interactive whiteboards, visualizers and other devices, teacher training and the development of digital content through e-textbooks. The authors estimated the effects on the test score distribution to be beyond the usual comparison of means. They found that the only significant result was a small effect that was on the lower part of the distribution of the reasoning scores. Tanui (2013) found that the allocation of funds ICT resources by the government of Kenya affected the learners' abilities to maximize the integration. This had a minimal effect on the KCSE performance of these learners.

In regards to the procurement policy of ICT devices and the availability of ICT in schools, Machin et al (2007) exploited a change in the rules governing the ICT funding in different school districts of England. They found that the availability of ICT in schools had a positive impact on primary school learners' performance in English and Science though not in Mathematics. However, Gui et al. (2018) presented a counterfactual evaluation on the resources allocated for the procurement of ICT school equipment on the performance of 6<sup>th</sup> grade learners

in Italy. It was concluded that despite a substantial economic investment, 1500 Euros per learner in a three-year period, the intervention was found to be far from cost effective based on the minimal effects on learners' performance. Kenya's policy has supported the integration of ICT in education and this initiative continues to receive support by the government. Although the use of ICT in secondary schools continues to increase in Kenya, the Kenya National Examination Council (2008) stated that poor performance in KCSE continues to persist each year.

## **2.7 School Culture Performance of Public Secondary Schools in KCSE**

School culture refers to the set of accepted norms and beliefs that govern the conduct of a learning institution (Omusonga, Kazadi and Indoshi, 2009). Schools with cultures that favor a high expectation for academic recognition integrate different learning approaches in an attempt to improve their performances. Mwangi (2011) found that schools that have a culture which emphasizes on the good instructional policies, such as ICT integration performed better in KCSE as compared to those that had weak instructional policies. The creation of an environment that motivates learning through ICT integration was also found to improve KCSE performance as the learners developed curiosity in learning through technology hence increased learning motivation (Darcia, 2010).

A positive school culture through ICT integration includes the active involvement of stakeholders that include parents and the community. According to the Character Education Partnership (CEP, 2010), a successful and inclusive school culture fosters academic excellence and ethics. Further, the participation and involvement of stakeholders offers learners the necessary support to perform better in their national examinations. A contribution to the integration of ICT by stakeholders brings together a united front that can support the learners and hence better performance in KCSE (Indimuli, 2013).

## **2. 8 Theoretical Framework**

This study was anchored on two theories: Diffusion of Innovations and Technology Acceptance Model.

### **2.8.1 Diffusion of Innovations**

The Diffusion of Innovations theory was propounded by Everett M. Rogers in 1962. Roger's theory shares the idea of a process by which an innovation is communicated through certain channels overtime among the members of a social system. This process begins with knowledge of the first channel which is represented by the characteristics of decision-making unit by the ICT users so as to integrate technology. The process then ends with confirmation by the users to accept the technology and integrate it accordingly. According to Rogers (1995), the innovations should have a perceived newness which should have a perceived benefit to the user. This theory relates to the study in that it focuses on the introduction and integration of ICT in public secondary schools as a decision by the government through the Ministry of Education. To further determine its perceived benefits to the learners, this study focuses on measuring the output through the performance of learners through their KCSE results and transition to tertiary education. Rogers, and Sabido (2003) maintain that ICT to be adopted and integrated, it should be easy to understand, available for trial, observable and have visible results.

### **2.8.2 Technology Acceptance Model**

The Technology Acceptance Model was developed by Davis (1989) and it is one of the most popular research models that is used to predict the use and acceptance of information systems and technology by users. The model focuses on two factors: the perceived usefulness and the perceived ease of use in relevant behavior related to computer use. Perceived usefulness is the prospective user's subjective probability that using the system will enhance their output or life performance. Perceived ease of use is defined as the degree to which the user expects the system to be free of effort. These two factors are influenced by external variables such as facilitating conditions, political involvement, language and skill. In line with this study, integration of ICT in education is heavily influenced by the availability of ICT infrastructure, the development of digital content, capacity building of the teachers and the procurement process which is focused on funding. Uwadia (2009) asserts that ICT serves as a tool for productivity and effective decision making. This ensures the effective delivery of lessons,

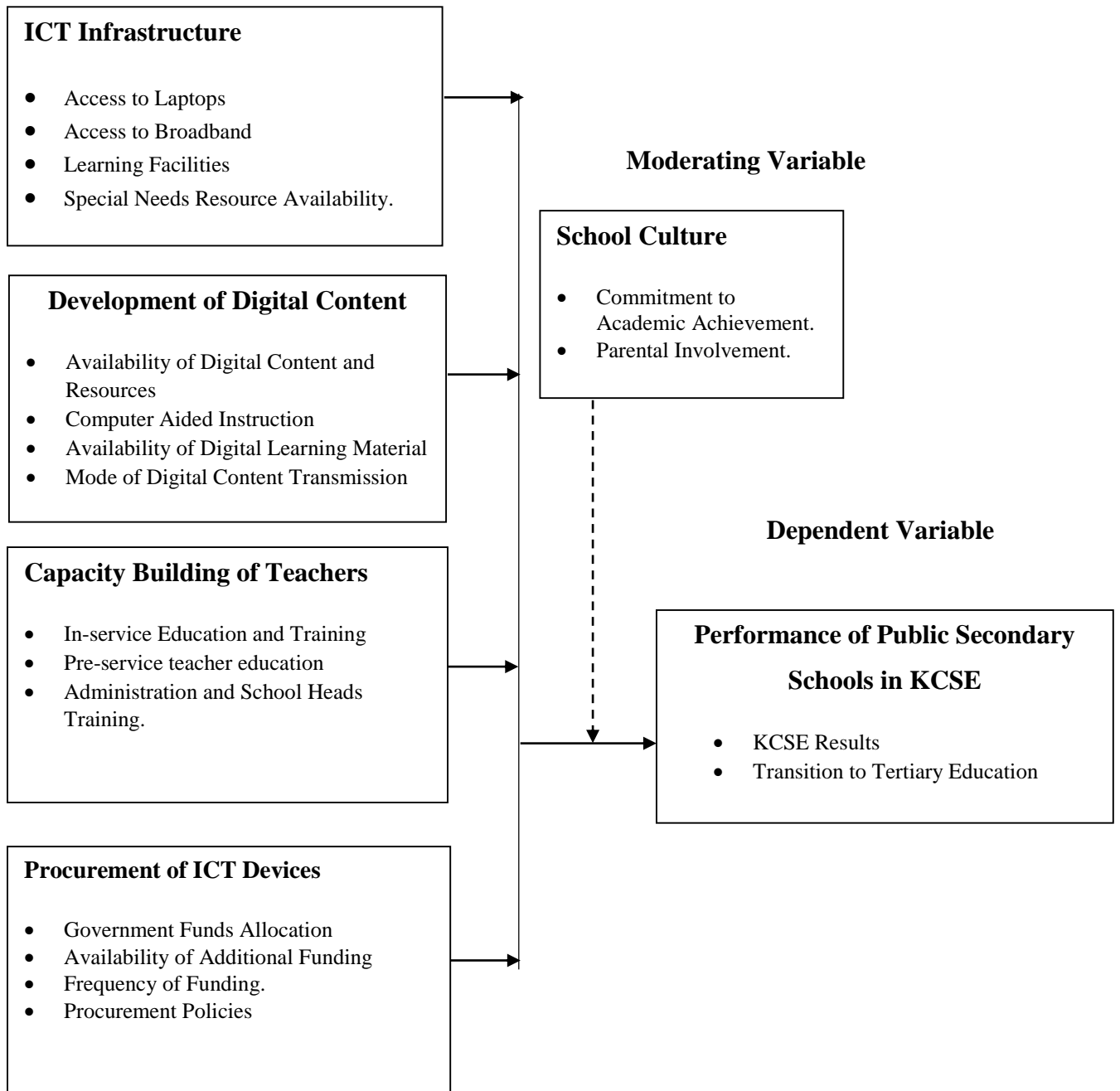


effective communication to stakeholders, effective maintaining of the ICT system which may have a positive impact on the performance of learners.

## **2.9 Conceptual Framework**

A conceptual framework is a diagrammatic representation of the perceived relationship that exists between the independent variables which are the integration of ICT and the dependent variable which is the learner performance.

## Independent Variables



**Figure 1: Conceptual Framework**

The model of the conceptual framework is illustrated in figure 1 above. The independent variable which is conceptualized as ICT infrastructure, development of digital content, capacity building of teachers and procurement of ICT devices are placed on the left of the diagram and each has a direct interaction with the learner performance which is the dependent variable. ICT infrastructure will be measured by the following indicators; access to laptops, access to broadband, learning facilities and special needs resource availability. Development of digital content will be measured by the availability of digital content and resources, use of computer aided instructions, availability of digital learning material and the mode of digital content transmission. The third variable, capacity building of teachers will be measured by the in-service education and training, pre-service teacher education, administration and school heads training. The final variable, procurement of ICT devices will have the following indicators: government funds allocation, availability of additional funding, frequency of funding and procurement policies. The dependent variable, on learner performance in KCSE will be measured using the following indicators; KCSE results and transition into tertiary institutions.

## **2.10 Knowledge Gap**

The literature review provides a substantive theoretical and empirical evidence on the influence of ICT integration projects on performance of public secondary schools in KCSE in Kiambu County, Kenya.

Below, table 2.1 provides a matrix table giving a summary of the empirical studies reviewed and the perceived knowledge gaps.

**Table 2.1: Knowledge Gap Matrix**

Variable	Authors (year)	Title of the study	Findings and Conclusions	Knowledge gaps
ICT Infrastructure	Holcomb, L.B (2009)	Results & Lessons Learned from 1:1 Laptop Initiatives: A Collective Review	Using a meta-analysis research design, the study found that the availability of laptops supports significant opportunities within the educational setting.	The study did not focus on the influence of ICT infrastructure on performance in Public Secondary Schools in KCSE. Research is required to show the influence it has on performance.
	Hyland et al. (2014)	Are Classroom Internet Use and Academic Performance Higher after Government Broadband Subsidies to Primary Schools?	The study was based on a cross-section research design. The study found that use of the internet in class was associated with significantly higher average mathematics scores on standardized tests.	The study did not investigate the influence of ICT infrastructure on performance in Public Secondary Schools in KCSE.

	<p>Mingaine, L. (2013)</p> <p>Fakrudeen, et al. (2017)</p>	<p>Leadership Challenges in the Implementation of ICT in Public Secondary Schools in Kenya</p> <p>Success criteria for implementing technology in special education: a case Study</p>	<p>Under a survey research methodology, the study found that to successfully integrate ICT in schools, a good quality electricity is a basic provision.</p> <p>This study relied on a multi-methodological approach (Qualitative and Quantitative methods). The study found that successful implementation of ICT in special education requires the use of assistive hardware and software</p>	<p>The study did only focus on the integration of ICT in schools rather than its influence on performance. Research is required to show the results of integration through KCSE performance of public secondary schools.</p> <p>The study only focused on the implementation of ICT and did not focus on the outcomes through assessing KCSE performance for special needs learners in public secondary schools.</p>
<p>Development of Digital Content</p>	<p>Zwart, et al. (2017)</p>	<p>The effects of digital learning material on learners' mathematics learning in vocational education.</p>	<p>The study found out that learning enhancement was mostly due to the use of instructional clips and structuring of the content of the mathematics tasks. The research design employed was a pre-test post-test design.</p>	<p>The study failed to focus on the overall performance of the learner using digital content, hence research is required to show the influence of digital content on performance in public secondary schools in KCSE.</p>

	Scholars under the Scholars Strategy Network (2014)	Digital tools in K-12 classrooms and learner achievement: Weighing the evidence	These scholars relied on an observational design. The study showed that digital tools do not regularly add value to instruction, even when the technology is readily accessible and working well.	The study focused on the digital tools as a measure of learner achievement rather than performance. Hence the need to research on the influence of digital content on performance in public secondary schools in KCSE.
Capacity Building of the teachers	Kadiri, (2015)	Teacher-based factors influencing integration of information communication technology in teaching of English language in Public Secondary Schools in Vihiga Sub-County Kenya	The study concluded that head teachers' readiness for integration of information communication technology was influenced by head teacher's ICT training levels, availability of ICT facilities, head teacher's computer usage as well as school head teachers' attitude towards ICT integration.	The study failed to address the need of capacity building in integration of ICT for performance in public secondary schools in KCSE.
Procurement of ICT devices	Machin et al. (2007)	New Technology in Schools: Is There a Payoff?	The study finds that policy developments related to ICT funding in schools have a positive outcome on school performance in English and Science, though not Mathematics.	The study focused on ICT investments on education performance with focus on two subjects rather than the overall performance in public secondary schools in KCSE.

## **2.11 Summary of Literature Review**

This chapter has focused on the empirical review of literature related to the influence of ICT integration projects on performance of public secondary schools in KCSE. The literature has shown the influence of ICT integration through ICT infrastructure, development of digital content, capacity development of teachers and procurement of ICT devices on performance of public secondary schools in KCSE as explained in different empirical researches. The theoretical framework is based on: diffusion of innovations and the technology acceptance model. This has also been linked to the variables discussed in the study. The conceptual framework shows a summary of the relationship between the dependent and independent variables and the intervening variable. A knowledge gap matrix has also been included to show the gaps that this study will fill.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter describes the methodology that will be used in conducting the study. This includes; research design, target population, sampling procedure, methods of data collection, validity and reliability, methods of data analysis, operational definition of variables and ethical issues.

#### **3.2 Research Design**

Research design is defined as the clearly defined structures within which a study is implemented (Burns and Grove, 2001). This study adopted a descriptive research design which is used to gather information as they are during the study period. The descriptive research design was preferred because it ensured the complete description of the situation and ensured that there was minimum bias in the process of data collection (Kothari, 2003). Descriptive research method focuses on collecting information through the administration of questionnaires to a sample of individuals as it will allow the researcher to generate both descriptive and numerical data in measuring the variables.

#### **3.3 Target Population**

A target population is a full set of cases from which the sample is drawn (Kothari, 2004). The target population is comprised of an aggregate of individuals with similar traits and with respect to the area of study. This target population therefore constituted all the public secondary schools in Kiambu County totaling to 277 with teacher population of 3479. Therefore, population was as follows: head teachers will be 277, ICT Head of Department 277 and 3479 teachers which gives a total population of 4,033. This data on the number of schools and teachers in Kiambu County was collected from the County Education Office in Kiambu Town.



**Table 3.1: Target Population**

<b>Category</b>	<b>Target population</b>
Head Teachers	277
ICT Head of Departments	277
Teachers	3479
<b>Total</b>	<b>4033</b>

**Source:** (Kiambu County, 2019)

### **3.4 Sample Size and Sampling Procedure**

The purpose of this section is to describe the sample procedure that will be used in this study. Kothari (2004) defines a sample as a subset of the entire target population. A sufficient sample should be a representative of the target population.

#### **3.4.1 Sample Size Determination**

This study used the Fishers formula to arrive at the sample size. The formula was used as outlined below:

$$nf = n/1 + (n) N$$

Where;

nf = the desired sample size (if the target population is less than 10,000).

n = the desired sample size (when the population is more than 10,000)

N = the estimate of population size.

Thus;

$$n = Z^2 pq / d^2$$

There was no available estimate of the proportion in the target population, therefore, it is assumed to have the characteristics of interest, and 50% was used as recommended by Fisher et al.

Therefore,

The target population has a characteristic of .50, with the z-statistic as 1.96 and the degree of precision is .05, the sample size is:

$$n = \frac{(1.96)^2 (.50) (.50)}{(.05)^2}$$

$$=384$$

The desired sample size for this research is therefore:

$$nf = n / 1 + (n) / N$$

Where

$$n = 384$$

$$N = 4033$$

$$nf = \frac{384}{1 + \left(\frac{384}{4033}\right)}$$

$$nf = 350.62 = 351 \text{ (Rounded off)}$$

### 3.4.2 Sampling Procedure

Mugenda and Mugenda (2003) define sampling procedure as the systematic process of identifying the individuals in the study as a representative of the larger group they have been selected from. This study adopted three sampling procedures. First the Fisher's model to determine the sample size of the entire population. Secondly, this study used cluster sampling approach to divide the population into 12 sub-counties. A simple random sampling was then used to choose one sub-county. Thirdly, the number of head teachers, ICT head of departments and teachers included in the sample were decided through stratified random sampling while purposive sampling was used to select the head teachers and ICT head of departments in the study and simple random sampling to select teachers in each school.

**Table 3.2: Sample Size Determination**

<b>Category</b>	<b>Target population</b>	<b>Sample Size</b>
Head Teachers	277	24
ICT Head of Department	277	24
Teachers	3479	303
<b>Total</b>	<b>4033</b>	<b>351</b>

### **3.5 Research Instruments**

This study relied on questionnaires to collect primary data. Questionnaires were used because they are easy to administer and allowed respondent adequate time to arrive at a well thought out responses and eliminate researcher bias. The survey used self-administered questionnaires to collect primary data from 24 head teachers, 24 ICT head of departments and 303 teachers in public secondary schools in Kiambu County. The questionnaire contained close-ended questions anchored on a 5-point Likert scale. This scale was able to measure the perceptions, values, attitudes and behavior (Kumar, 2014). The questionnaire was divided into five sections: section one addressed the demographic characteristics of the respondents focusing on the distribution of the respondents by age, gender, level of education and income level. Section two, three, four and five addressed the statements related to variables and indicators of the study.

#### **3.5.1 Pilot Testing**

A research instrument should be subjected to a pilot study prior to undertaking the main study (Kothari, 2004). The piloting for this research instrument was carried out among a few selected respondents that were outside the selected sample. The study considered pretesting 10% of 351 which is the sample size and obtained 35 instruments for the pilot test. Mugenda and Mugenda (2003) state that pretesting reveals errors prior to the actual data collection and 10% is considered a satisfactory proportion for the pilot study. Pretesting was done in Nairobi County since the county has similar characteristics with the study are. The pre-test targeted head teachers, ICT head of departments and teachers within Nairobi County. The purpose of this

pilot test was to establish validity and reliability of the research instruments and to enhance the validity.

### **3.5.2 Validity of the Research Instruments**

Validity is defined as the meaningfulness and accuracy of inferences which are based on the research results (Mugenda and Mugenda, 2003). It provides the degree to which results obtained from the analysis of data is a representation of the phenomenon being studied. Best and Kahn (2011) state that content validity can be enhanced using expert judgement. The researcher prepared the instrument with consultation with the research supervisors to ensure that the specific areas and objectives are covered by the instruments. Expert judgement helped the researcher identify the weaknesses of the research instruments and make appropriate corrections to increase validity.

### **3.5.3 Reliability of the Research Instruments**

Reliability of the research instruments focuses on the extent to which the instruments yield similar results over several repeated trials (Orodho, 2005). A reliable instrument is one which has small errors of measurements, showing stability, consistency and the dependability of scores of individuals on the trait, behavior or characteristic being examined (Statford, 1989). This study used the test-retest method which involves giving the same test to the same individuals on two occasions and correlating the scores. This is by giving the 35 respondents the same instrument on two separate occasions. The correlation between these two scores was established by computing Cronbach's coefficient alpha of internal consistency. This measures how closely related a set of items in a group or study and as Creswell (2014) indicates, a reliable research instrument should be able to present a composite coefficient for  $\alpha$  of at least 0.7 for all the items included in a study. The instruments were found to be reliable since the results from the coefficient was obtained as 0.762 which is greater than the cut-off 0.70 and therefore, the instrument was deemed reliable.

## **3.6 Data Collection Procedure**

The researcher sought authorization to conduct research from the University of Nairobi through an introductory letter and then proceed to secure a permit from the National Commission for Science, Technology and Innovation (NACOSTI). After selecting and finalizing the tools required for data collection, the researcher visited the schools under investigation to take prior permission from the head teacher of the schools for collecting the required data. Subsequently,

the research discussed in detail what the investigation included and explained the nature and purpose of the research. In the first phase, the researcher ensured that the procedure to fill in the questionnaire was clearly explained. So as to give responses that are honest, free and sincere, the researcher informed them that there were no wrong answers and that their professional careers will not be affected by this research as the data would be strictly for research purposes and their responses were to be kept confidential. The questionnaires were distributed for a period of two weeks to ensure sufficient data collection. The researcher and a research assistant, trained by the researcher, were present during the filling of the questionnaires to offer guidance.

### **3.7 Data Analysis Techniques**

The raw data that was collected on the variables was compiled by editing for the purposes or completeness and removing errors before it was coded for analysis to ensure that the data was free from incompleteness and inconsistencies Nachmias et al, (2014). A codebook was developed in the analysis and it was used to code the data. Kumar (2014) states that a codebook offers the set of rules that are used to assign numerical values to responses that are obtained from the respondents. This codebook was tabulated and analysed using Statistical Package for Social Sciences (SPSS), a tool for data analysis. The study used descriptive data analysis method since the design used was descriptive. Descriptive statistics was used to bring out the characteristics of the data by calculating statistics such as mean, standard deviation and presenting the data in frequency distribution tables. Pearson correlation coefficient was used to determine the relationship between the variables in the study.

### 3.8 Operationalization of Variables

**Table 3.3: Operationalization of Variables**

Objectives	Variables	Measurement	Measurement Scale	Tools of Analysis
<b>To assess the influence of ICT infrastructure on performance of public secondary schools in KCSE in Kiambu County, Kenya</b>	ICT Infrastructure	-Access of Laptops/Tablets.	Ordinal	Means, Standard deviation, Deviation, Frequencies, Percentage and Correlation.
		- Access of Broadband.	Nominal	
		-Required Learning Facilities.	Interval	
		-Special Needs Facilities.		
<b>To examine the influence of development of digital content on performance of public secondary schools in KCSE in Kiambu County, Kenya.</b>	Development of Digital Content	-Use of Digital Content.	Ordinal	Means, Standard deviation, Deviation, Frequencies, Percentage and Correlation.
		-Computer Aided Instruction.	Nominal	
		-Use of Digital Learning Material.	Interval	
		-Digital Content Transmission.		

<b>To determine the influence of capacity building of teachers on performance of public secondary schools in KCSE in Kiambu County, Kenya</b>	Capacity Building of Teachers	-In-Service Education and Training. -Pre-service teacher education. -School Heads Training.	Ordinal Nominal Interval	Means, Standard deviation, Deviation, Frequencies, Percentage and Correlation.
<b>To examine the influence of procurement of ICT devices on performance of public secondary schools in KCSE in Kiambu County, Kenya.</b>	Procurement of ICT devices	-Government Funding. -Additional Funding. -Frequency of Funding. -Government Funding Policy	Ordinal Nominal Interval	Means, Standard deviation, Deviation, Frequencies, Percentage and Correlation.
<b>Performance in Public Secondary Schools in KCSE</b>	Performance of Learners in Public Secondary Schools in KCSE	-KCSE Results -Transition to tertiary institutions.	Ordinal Nominal Interval	Means, Standard deviation, Deviation, Frequencies, Percentage and Correlation.

### **3.9 Ethical Considerations**

The researcher observed the following standards of behavior in regards to the rights of the participants. Informed the participants on the objectives of the study and the confidentiality through a letter that enabled them to give informed consent. Privacy was also observed where the objectives of the study were to be explained to the respondents with an assurance that the data, they provided would be used for academic purposes only. Authority and consent for data collection was sought from relevant authorities such as the Ministry of Education in Kiambu County, the National Commission for Science, Technology and Innovation (NACOSTI) and a consent letter for the University of Nairobi. The purpose of the research was disclosed to the respondents through a letter of transmittal.



## CHAPTER FOUR

### DATA ANALYSIS, PRESENTATION AND INTERPRETATION

#### 4.1 Introduction

This chapter focuses on data analysis, presentation and interpretation of results. The chapter contains analysis based on the demographic characteristics of the respondents in terms of age, gender, level of education and the number of years in management. The chapter also contains analysis based on the thematic areas drawn from the objectives.

#### 4.2 Questionnaire Return Rate

The researcher administered 351 research instruments out of which 306 were fully filled and returned by the respondents. This gave a questionnaire return rate of 87.18%. This questionnaire return rate was considered satisfactory for analysis to make conclusions for the study in accordance to Mugenda and Mugenda, (2003) who indicate that, a response rate of 50% is adequate, 60% is good and 70% very good for analysis and reporting from manual surveys. Table 4.1 shows the response return rate.

**Table 4.1: Questionnaire Return Rate**

<b>Research Instruments</b>	<b>Frequency</b>	<b>Response Rate</b>
Responses	306	87.18%
Not returned	45	12.82%
<b>Total</b>	<b>351</b>	<b>100.00%</b>

#### 4.3 Reliability Coefficients

The results for the reliability coefficients are shown in the Table 4.2

**Table 4.2: Reliability Coefficients of the variables**

<b>Variables</b>	<b>Items</b>	<b>Cronbach Alpha Coefficient result</b>
ICT Infrastructure	35	0.761
Development of digital Content	35	0.717
Capacity building for teachers	35	0.841
Procurement of ICT devices	35	0.729
<b>Combined mean</b>		<b>0.762</b>

Cronbach's alpha (Cronbach coefficient alpha), which is based on internal consistency, was calculated using SPSS to establish the reliability of the survey instrument. This methodology measures the average of measurable items and its correlation. Field (2009) contends that Cronbach's alpha value that is at least 0.70 suffices for a reliable research instrument. The instruments were found to be reliable since the results from the coefficient was obtained as 0.762 which is greater than the cut-off 0.70 and therefore, the instrument was deemed reliable.

#### **4.4 Demographic Characteristics of the Respondents**

This section discusses the demographic characteristics of the respondents in the study. These include; distribution of respondents by their gender, highest level of education and the number of years in ICT.

##### **4.4.1 Distribution of Respondents by Gender**

In this section the researcher sought to establish the gender of the respondents. Their responses are shown in Table 4.3

**Table 4.3: Distribution of Respondents by Gender**

<b>Gender</b>	<b>Frequency</b>	<b>Percent</b>
Male	149	48.7
Female	157	51.3
<b>Total</b>	<b>306</b>	<b>100.0</b>

The respondents were required to indicate their gender; the results show that 149 (48.7%) of the respondents were males while 157 (51.3%) of the respondents were females. This infers that the researcher collected data from all the respondents regardless of their gender. This implies that there were more female respondents than males and that teaching which results to performance of public secondary schools in KCSE in Kiambu County, is a female dominated sector.

#### 4.4.2 Distribution of Respondents by Highest Level of Education

The researcher asked the respondents to indicate their highest level of education. Table 4.4 summarizes their responses,

**Table 4.4: Distribution of Respondents by highest level of Education**

<b>Level of Education</b>	<b>Frequency</b>	<b>Percentage</b>
College Diploma	34	11.1
Bachelor degree	144	47.1
Post-Graduate Diploma	50	16.3
Master Degree	63	20.6
PhD Degree	15	4.9
<b>Total</b>	<b>306</b>	<b>100.0</b>

The respondents were required to indicate their level of education. The results show that 34 (11.1%) of the respondents had attained a college diploma; 144(47.1%) had attained bachelor degree; 50 (16.3%) were on the Post-graduate diploma level; 63(20.6%) had attained a Master’s degree while 15(4.9%) of the respondents were still pursuing their doctor of philosophy degrees. This implies that majority of the respondents had a bachelor’s degree which is considered a requirement to teach in secondary schools in Kenya. However, the minimum requirement for secondary school teaching is a college diploma. The findings infer that the respondents were learned enough to give reliable information on the study.

#### 4.4.3 Distribution of Respondents by Years of Experience in ICT

The researcher further sought to explore the respondent's years of experience in using ICT. The results are indicated in the Table 4.5

**Table 4.5: Number of Years of experience in ICT**

Number of years in	Frequency	Percentage
Less than 1 year	31	10.1
1 – 2 years	120	39.2
3 – 4 years	138	45.1
Above 5 years	17	5.6
<b>Total</b>	<b>223</b>	<b>100.0</b>

Majority of the respondents, 138(45.1%) indicated that they had at least 3 – 4 years of experience in information communication technology, this was followed closely by individuals with 1 – 2 years of experience at 120(39.2%); those with less than 1 year experience were 31(10.1%) whereas those with experience above 5 years in information communication technology use were 17 (5.6%). This is an indication that most of the respondents were familiar with integration of information communication technology in public secondary schools and their years of experience could influence performance of public secondary schools in KCSE in Kiambu County.

#### 4.5 ICT Infrastructure and Performance of Public Secondary Schools in KCSE

The first independent variable sought to assess the extent to which ICT infrastructure influences performance of public secondary schools in KCSE in Kiambu County, Kenya. To achieve this the respondents were asked to give their opinion on the level of agreement or disagreement with the statement using a 5-point Likert scale where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The results are presented in Table 4.6.

**Table 4.6: ICT Infrastructure and Performance of Public Secondary Schools in KCSE**

Statements	1	2	3	4	5	Mean	SD
1. Access to laptops and tablets influences performance in public secondary schools in KCSE.	6(2.0)	20(6.5)	32(10.5)	138(45.1)	110(35.9)	4.15	0.77
2. Access to broadband influences performance in public secondary schools in KCSE.	50(16.3)	56(18.3)	66(21.6)	117(38.2)	17(5.6)	3.28	0.86
3. Learning facilities influence performance in public secondary schools in KCSE.	16(5.2)	106(34.6)	57(18.6)	93(30.4)	34(11.1)	3.08	1.14
4. Special needs facilities influence performance in public secondary schools in KCSE	44(14.4)	50(16.3)	72(23.5)	108(35.3)	32(10.5)	3.25	1.00
<b>Composite Mean</b>						<b>3.44</b>	<b>0.94</b>

From the findings in regards to the first statement, the access to laptops and tablets influences performance in public secondary schools in KCSE, the results were as follows: 110 (35.9%) strongly agreed, 138(45.1%) agreed 32(10.5) were neutral about the statement, 20(6.5%) disagreed and 6(2%) strongly disagreed with a mean and standard deviation of 4.15 and 0.77 respectively. The findings indicate that access to laptops and tablets has a positive influence on the variable and this influences performance of public secondary schools in KCSE since the line item mean obtained (4.15) for the statement is greater than the composite mean calculated of 3.44.

On whether access to broadband influences performance in public secondary schools in KCSE, the study found out that 17 (5.6%) strongly agreed, 117(38.2%) agreed, 66(31.6%) had a neutral opinion, 56(18.3%) disagreed, while 50(16.3%) strongly disagreed with the statement. The resultant mean and standard deviation were 3.28 and 0.86 respectively. This implies that access to broadband has a negative influence on performance in public secondary schools in KCSE since the mean of 3.28 is below the composite mean of 3.44.

As per the findings on the statement, learning facilities influence performance in public secondary schools in KCSE, the findings were as follows: 34(11.1%) strongly agreed with the statement, 93(30.4%) agreed, 57(18.6%) held a neutral opinion, 106(34.6%) disagreed while

16(5.2%) strongly disagreed. The resulting mean and standard deviation were 3.08 and 1.14 respectively. From these descriptive findings, most of the respondents disagreed with the statement, hence learning facilities negatively influence performance of public secondary schools in KCSE. This is supported by the mean of 3.08 which falls lower than the composite mean of 3.44.

On whether special needs facilities influence performance in public secondary schools in KCSE, the study obtained the following results; 32(10.5%) strongly agreed, 108(35.3%) agreed, 72(23.5%) were neutral, 50(16.3%) disagreed and those who strongly disagreed 44(14.4%). The resulting mean and standard deviation were 3.25 and 1.00 respectively. This implies that special needs facilities are important as supported by 35.3% of the respondents. However, the mean for this statement falls below the composite mean implying that maybe special needs facilities have a negative influence on performance of public secondary schools in KCSE as indicated by 3.25 against 3.44 which is the composite mean.

#### **4.6 Development of Digital Content and Performance of Public Secondary Schools in KCSE**

The second independent variable sought to examine the influence of development of digital content on performance of public secondary schools in KCSE in Kiambu County, Kenya. To achieve this the respondents were asked to give their opinion on the level of agreement or disagreement with the statement using a 5-point Likert scale where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The results are presented in Table 4.7.

**Table 4.7: Development of Digital Content and Performance of Public Secondary Schools in KCSE**

Statements	1	2	3	4	5	Mean	SD
1. Digital content and resources influence performance in public secondary schools in KCSE	55(18.0)	38(12.4)	69(22.5)	110(35.9)	34(11.1)	3.10	1.28
2. Computer aided instruction influences performance in public secondary schools in KCSE	25(8.2)	63(20.6)	84(27.5)	85(27.8)	49(16.0)	3.23	1.19
3. Digital learning materials influence performance in public secondary schools in KCSE	32(10.5)	26(8.5)	69(22.5)	119(38.9)	60(19.6)	3.49	1.20
4. Digital content transmission influences performance in public secondary schools in KCSE	3(1.0)	8(2.6)	63(20.6)	157(51.3)	75(24.5)	3.96	0.80
<b>Composite Mean</b>						<b>3.45</b>	<b>1.12</b>

From the study, on whether digital content and resources influence performance in public secondary schools in KCSE, the results indicate that 34(11.4%) strongly agreed, 110(35.9%) agreed, 69(22.5%) were neutral, 38(12.4%) disagreed and 55(18%) strongly disagreed with a mean and a standard deviation of 3.10 and 1.28 respectively. This implies that the digital content and resources has a negative influence since the mean, 3.10, falls below the composite mean which is 3.45. This indicates that digital content and resources negatively influence performance in public secondary schools in KCSE.

The second line item sought to find out whether computer aided instruction influences performance in public secondary schools in KCSE, the study obtained the following results; 49(16.0%) strongly agreed, 85(27.8%) agreed, 84(27.5%) were neutral, 63(20.6%) disagreed and those who strongly disagreed 25(8.2%) with a mean and standard deviation of 3.23 and 1.19 respectively. The line item mean, 3.23, as compared to the composite mean indicates a negative influence on computer aided instructions in performance of public secondary schools since it falls below the composite mean which is 3.45.

The third line item study found out on whether digital learning materials influence performance in public secondary schools in KCSE. The findings on Table 4.7, indicate that 60(19.6%)

strongly agreed, 119(38.9%) agreed, 69(22.5%) were neutral about the line item statement, 26(8.5%) disagreed and 32(10.5%) strongly disagreed with a mean and standard deviation of 3.49 and 1.20 respectively. The findings indicate that digital learning materials influence performance in public secondary schools in KCSE as supported by 58.5% who strongly agreed and agreed. This implies that the third line item has a positive influence on the variable as demonstrated by the direction of the line item mean 3.49 which is greater than the composite mean 3.45.

The study found out on whether digital content transmission influences performance of public secondary schools in KCSE. Those who strongly agreed had a representation of 75(324.5%), agreed 157(51.3%), neutral 63(20.6%), disagreed 8(2.6%) and strongly disagreed 3(1%) respectively. This produced a mean and a standard deviation of 3.96 and 0.80. This implies that the line item 4 has a strong influence on the variable and thus positively contributes to positively influencing the relationship between information communication technology integration and performance of public secondary schools in KCSE.

#### **4.7 Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE**

The third variable sought to determine the extent to which capacity building for teachers' influences performance of public secondary schools in KCSE in Kiambu County, Kenya. To achieve this the respondents were asked to give their opinion on the level of agreement or disagreement with the statement using a 5-point Likert scale where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The results are presented in Table 4.8



**Table 4.8: Capacity Building of the Teaches and Performance of Public Secondary Schools in KCSE**

Statements	1	2	3	4	5	Mean	SD
1. In service education and training influences performance in public secondary schools in KCSE	10(3.3)	17(5.6)	29(9.5)	142(46.4)	108(35.3)	4.15	0.81
2. Pre-service teacher education influences performance in public secondary schools in KCSE	19(6.2)	20(6.5)	50(16.3)	148(48.4)	69(22.5)	4.00	0.71
3. School heads training influences performance in public secondary schools in KCSE	7(2.3)	65(21.2)	77(25.2)	118(38.6)	39(12.7)	3.04	1.10
<b>Composite Mean</b>						<b>3.73</b>	<b>0.87</b>

On whether in service education and training influences performance in public secondary schools in KCSE, the results are indicated on the Table 4.8. The findings indicate that, 108(35.3%) strongly agreed, 142(46.4%) agreed, 29(9.5%) were neutral about the statement, 17(5.6%) disagreed and 10(3.3%) strongly disagreed with a mean and standard deviation of 4.15 and 0.81 respectively. The findings implied that in-service education and training influences performance in public secondary schools in KCSE as compared to the composite mean (3.73) and as supported by 81.7% majority who agreed and strongly agreed.

The study found out on whether pre-service teacher education influences performance in public secondary schools in KCSE as indicated on Table 4.8 where 69(22.5%) strongly agreed, 148(48.4%) agreed, 50(16.3%) of the respondents indicated neutral, 20(6.5%) disagreed and 19(6.2%) strongly disagreed. The statement drew a mean and standard deviation of 4.00 and 0.71 respectively which as compared to the composite mean (3.73) implies that pre-service teacher education influences performance in public secondary schools in KCSE as agreed by majority of the respondents at 70.9%.

The study sought to find out whether school heads training influences performance in public secondary schools in KCSE. Respondents who strongly agreed were 39(12.7%), 118(38.6%) agreed, 77(25.2%) of the respondents indicated neutral, 65(21.2%) disagreed and 7(2.3%). The statement drew a mean and standard deviation of 3.04 and 1.10 respectively which as compared to the composite mean (3.73) implies that the line item 3 under the variable has a negative

influence since it falls below the composite mean as compared to the other line items which are greater than the composite mean.

#### 4.8 Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE

The fourth variable was to examine the influence of procurement of ICT devices on performance of public secondary schools in KCSE in Kiambu County, Kenya. To achieve this the respondents were asked to give their opinion on the level of agreement or disagreement with the statement using a 5-point Likert scale where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The results are presented in Table 4.9

**Table 4.9: Procurement of ICT Devices and Performance of Public Secondary Schools in KCSE**

Statements	1	2	3	4	5	Mean	SD
1. Government funding for procurement of ICT devices influences performance in public secondary schools in KCSE	29(9.5)	35(11.4)	60(19.6)	136(44.4)	46(15)	3.62	0.85
2. Additional funding for procurement of ICT devices influences performance in public secondary schools in KCSE	9(2.9)	35(11.4)	63(20.6)	136(44.4)	63(20.6)	3.68	1.02
3. Frequency of funding for procurement of ICT devices influences performance in public secondary schools in KCSE	55(18)	38(12.4)	69(22.5)	110(35.9)	34(11.1)	3.10	1.28
4. Government funding policy for procurement of ICT devices influences performance in public secondary schools in KCSE	32(10.5)	26(8.5)	69(22.5)	119(38.9)	60(19.6)	3.49	1.20
<b>Composite Mean</b>						<b>3.47</b>	<b>1.09</b>

On whether government funding for procurement of ICT devices influences performance in public secondary schools in KCSE, the results are indicated on the Table 4.9. The findings indicate that, 46(15%) strongly agreed, 136(44.4%) agreed, 60(19.6%) were neutral about the statement, 35(11.4%) disagreed and 29(9.5%) strongly disagreed with a mean and standard deviation of 3.62 and 0.85 respectively. The line item mean indicates that government funding

for procurement of ICT devices is vital as supported by 182(59.4%) of the respondents. This implies that line item has a positive influence on ICT integration and performance of public secondary schools in KCSE with the line item mean 3.62 being greater than the composite mean 3.47.

The study found out on whether additional funding for procurement of ICT devices influences performance in public secondary schools in KCSE as indicated on Table 4.9 where 63(20.6%) strongly agreed, 136(44.4%) agreed, 63(20.6%) of the respondents indicated neutral, 35(11.4%) disagreed and 9(2.9%) indicated strongly disagreed. The statement drew a mean and standard deviation of 3.68 and 1.02 respectively which as compared to the composite mean 3.47 implies that additional funding for procurement of ICT devices influences performance in public secondary schools in KCSE as agreed by majority of the respondents at 199(65.0%).

The study found out on whether frequency of funding for procurement of ICT devices influences performance in public secondary schools in KCSE as indicated on Table 4.9. Respondents who strongly agreed were 34(11.1%), 110(35.9%) agreed, 69(22.5%) of the respondents indicated neutral, 38(12.4%) disagreed and those who strongly disagreed were 55 representing 18%. The statement drew a mean and standard deviation of 3.10 and 1.28 respectively which as compared to the composite mean 3.47 implies that frequency of funding for procurement of ICT devices negatively enhances performance of public secondary schools in KCSE. This is in comparison between the line item mean 3.10 and the composite mean 3.47.

On whether government funding policy for procurement of ICT devices influences performance in public secondary schools in KCSE, the results are indicated on the Table 4.9. The findings indicate that, 60(19.6%) strongly agreed, 119(38.9%) agreed, 69(22.5%) were neutral about the statement, 26(8.5%) disagreed and 32(10.5%) strongly disagreed with a mean and standard deviation of 3.49 and 1.20 respectively. The line item mean indicates that government funding policy for procurement of ICT devices is supported by 179(58.5%) of the respondents. This implies that line item has a significant influence on ICT integration and performance of public secondary schools in KCSE with the line item mean 3.49 being greater than the composite mean 3.47.

#### 4.9 Performance of Public Secondary Schools in KCSE

The study also sought the views of the respondents concerning the dependent variable performance of public secondary schools in KCSE in Kiambu County, Kenya. To achieve this, respondents were asked to give their opinion on the level of agreement or disagreement with the statement using a 5-point Likert scale where 1= strongly disagree, 2 = disagree, 3 = neutral, 4 = agree and 5 = strongly agree. The results are presented in Table 4.10.

**Table 4.10: Performance of Public Secondary Schools**

Statements	1	2	3	4	5	Mean	SD
1. Commitment to academic performance influences performance in public secondary schools in KCSE	30(9.8)	39(12.8)	69(22.5)	111(36.3)	57(18.6)	3.51	1.04
2. Involvement of stakeholders and the community influences performance in public secondary schools in KCSE	6(2.0)	22(7.2)	30(9.8)	138(45.1)	110(35.9)	4.15	0.77
3. Overall mean score in the KCSE results in recent years (5 Years) is commendable	16(5.2)	106(34.6)	57(18.6)	93(30.4)	34(11.1)	3.08	1.14
4. Rate of learner's admission to tertiary learning institutions is considerable	39(12.7)	80(26.1)	55(17.9)	96(31.4)	36(11.8)	3.65	0.85
<b>Composite Mean</b>						<b>3.60</b>	<b>0.95</b>

On whether Commitment to academic performance influences performance in public secondary, most of the respondents agreed with a representation of 168(54.9%) out of the 306 total respondents. The mean for the line item 1 was 3.51 which was less than the composite mean. This implies that the line item negatively influences the variable in terms of information communication and technology integration on performance of public secondary schools in Kiambu County.

On involvement of stakeholders and the community influence on performance in public secondary schools in KCSE, the findings indicate that 110(35.9%) strongly agreed; 138(45.1%) agreed; 30(9.8%) were neutral whereas 22(7.2%) disagreed with 6 respondents represented by 2% strongly disagreed. This indicated that stakeholder involvement is key as supported by the line item mean 4.15 which is greater than the composite mean 3.60.

The findings also indicated that a significant majority of the respondents disagreed on the recent KCSE results as attributed by 122 respondents represented by 39.8 with 57(18.6%) indicating neutral and 127(41.5%) agreeing to the line item statement. This indicated that the integration of ICT in public secondary schools had a negative influence on whether the KCSE results were commendable in the recent years (5 years) due to the mean of 3.08 which is lesser than the composite mean of 3.60.

The findings also indicated on the rate of learners' admission to tertiary learning institutions being considerable; a significant number of respondents 132(43.2%) agreed that ICT integration influences performance of public secondary schools with 55(17.9%) neutral and a significant other disagreed 119(38.8%). This indicated that the integration of ICT in public secondary schools had a positive influence on the considerable rate of admissions to tertiary institutions due to the mean of 3.65 which is lesser than the composite mean of 3.60.

#### **4.10 Correlation Analysis**

Correlation analysis was done to determine the strength and direction of the relationship between ICT infrastructure, development of digital content, capacity building for teachers and procurement of ICT devices against the dependent variable performance of public secondary schools in Kiambu County, Kenya. The results are presented in the Table 4.11.

**Table 4.11: Correlation between the Explanatory variables and Performance of Public Secondary Schools in KCSE**

<b>Variable</b>		<b>ICT Infrastructure</b>	<b>Development of digital content</b>	<b>Capacity building of teachers</b>	<b>Procurement of ICT Devices</b>	<b>Performance of Public Secondary Schools</b>
<b>ICT Infrastructure</b>	Pearson Correlation	1	0.344	0.177	0.226	0.552
	Sig. (2-tailed)		0.000	0.002	0.000	0.000
	N	306	306	306	306	306
<b>Development of digital content</b>	Pearson Correlation	0.344	1	0.096	0.727	0.436
	Sig. (2-tailed)	0.000		0.093	0.000	0.000
	N	306	306	306	306	306
<b>Capacity building of teachers</b>	Pearson Correlation	0.177	0.096	1	0.088	0.232
	Sig. (2-tailed)	0.002	0.093		0.126	0.000
	N	306	306	306	306	306
<b>Procurement of ICT Devices</b>	Pearson Correlation	0.226	0.727	0.088	1	0.502
	Sig. (2-tailed)	0.000	0.000	0.126		0.000
	N	306	306	306	306	306
<b>Performance of Public Secondary Schools</b>	Pearson Correlation	0.552	0.552	0.232	0.502	1
	Sig. (2-tailed)	0.000	0.000	0.000	0.000	
	N	306	306	306	306	306

\*. Correlation is significant at the 0.05 level (2-tailed).

The results of the correlation indicate that there is a positive moderate correlation of 0.552 between ICT infrastructure and performance of public secondary schools in KCSE, which indicates a significant relationship with p-value of 0.000 which is less than the test level of significance 0.05. Similarly, development of digital content had a positive weak correlation of 0.436 against the response variable with the p-value being 0.000 less than the test level of significance 0.05. Correlation between capacity building for teachers and performance of public secondary schools in KCSE indicated a positive weak correlation of 0.232 with the p-value being 0.000 less than the test level of significance 0.05. Relationship between

procurement of ICT devices against the response variable indicated a positive moderate correlation of 0.502 being statistically significant at p-value 0.000.

#### 4.11 Regression Analysis

Regression analysis was done to determine the relationship between ICT infrastructure, development of digital content, capacity building for teachers and procurement of ICT devices against the dependent variable performance of public secondary schools in Kiambu County, Kenya. The results are presented in the Table 4.12.

**Table 4.12: Model Summary**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.684 <sup>a</sup>	.468	.461	1.37013

Table 4.11 illustrates the strength of the relationship performance of public secondary schools in Kiambu County, Kenya and independent variables. From the coefficient of determination, there is a strong relationship between dependent and independent variables given an R<sup>2</sup> values of 0.468 and adjusted R<sup>2</sup> value of 0.461. This shows that the independent variables; ICT infrastructure, development of digital content, capacity building of teachers and procurement of ICT devices; account for 46.8% of the variations in performance of public secondary schools in KCSE. This means that there are other factors than might be influencing performance of public secondary schools in KCSE that accounts for 53.2%.

##### 4.11.1 ANOVA Results

Analysis of variance (ANOVA) is a collection of statistical models used to analyse the differences among group means.

**Table 4.13: Table 4 ANOVA Test**

<b>Factor</b>	<b>Sum of Squares</b>	<b>Df</b>	<b>Mean Square</b>	<b>F</b>	<b>Sig.</b>
Regression	497.439	4	124.360	66.245	0.000
Residual	565.058	301	1.877		
<b>Total</b>	<b>1062.497</b>	<b>305</b>			

Dependent Variable: Performance of Public secondary schools in KCSE.

Predictors: (Constant), ICT infrastructure, development of digital content, capacity building of teachers and procurement of ICT devices.

Analysis of Variance (ANOVA) was used to test possible significant relationships between variables (dependent and independent variables). The probability value .000 does indicate that the regression relationship was highly significant in predicting how ICT infrastructure, development of digital content, capacity building of teachers and procurement of ICT devices influence performance of public secondary schools in KCSE. The F calculated at 5% level of significance is 66.245 which is greater than the F-critical value (2.4540) and p-value was less than 0.05, thus the overall model was significant.

#### **4.11.2 Regression Coefficient**

The regression coefficient is shown on the Table 4.13



**Table 4.14: Regression coefficient**

Variables	Un-standardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	3.922	0.724		5.416	.000
ICT Infrastructure	0.375	0.038	0.447	9.585	.000
Development of digital content	-0.018	0.044	-0.027	-0.422	.673
Capacity building of teachers	0.133	0.047	0.120	2.804	.005
Procurement of ICT devices	0.293	0.044	0.410	6.684	.000

a. Dependent Variable: Performance of Public Secondary schools in KCSE

The regression equation obtained from the outcome was:

$$Y = 3.922 + 0.447X_1$$

$$Y = 3.922 + (-0.027)X_2$$

$$Y = 3.922 + 0.120X_3$$

$$Y = 3.922 + 0.410X_4$$

As per the study, it was revealed that if all independent variables were held constant at zero, then the performance of public secondary schools in KCSE in Kiambu County will be 3.922. The findings, revealed that any unit increase in ICT infrastructure would lead to 0.447 increase in performance of public secondary schools in KCSE in Kiambu County. The variable was significant since p-value = 0.000 is less than 0.05.

The study further revealed that a unit change in development of digital content would lead to -0.027 units change in performance of public secondary schools in KCSE in Kiambu County, Kenya. The variable was not significant since p-value = 0.673 is greater than 0.05. Similarly, a unit change in capacity building of teachers would lead to 0.120 units change in performance of public secondary schools in KCSE in Kiambu County and lastly, a unit change in

procurement of ICT devices would lead to 0.410 units change in performance of public secondary schools in KCSE in Kiambu County.

## CHAPTER FIVE

### SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

#### 5.1 Introduction

This chapter contains a summary of the findings, discussions, conclusions and recommendations as per the research objectives of the study.

#### 5.2 Summary of Findings

The study focused on the key variables in chapter four and gave a summary of the findings.

##### 5.2.1 ICT infrastructure on performance of public secondary schools in KCSE

The study sought to assess the extent to which ICT infrastructure influences performance of public secondary schools in KCSE. The study revealed that any unit increase in ICT infrastructure would lead to 0.447 change in performance of public secondary schools in KCSE. The study also revealed that ICT infrastructure has an influence on performance of public secondary schools in KCSE as shown by a composite mean of 3.73, and that the contributing factors are access to laptops and tablets with a mean of 4.15 and special need facilities with a mean of 3.25 enhance performance in public secondary schools in KCSE

##### 5.2.2 Development of digital content on Performance of Public Secondary Schools in KCSE

The study revealed that any unit increase in development of digital content would lead to - 0.027 change in performance of public secondary schools in KCSE. The study also revealed that development of digital content through digital learning materials with a mean score of 3.49 and digital content transmission with an average of 3.96 influence performance in public secondary schools in KCSE.

##### 5.2.3 Capacity building of teachers on Performance of Public Secondary Schools in KCSE

The study sought to show the influence of capacity building of teachers on performance of public secondary schools in KCSE. The study revealed that any unit increase in capacity building of teachers would lead to 0.120 change in performance of public secondary schools in

KCSE. The study also revealed that in-service education and training with an average of 4.15 and pre-service teacher education with a mean of 4.00 influences performance in public secondary schools in KCSE.

#### **5.2.4 Procurement of ICT devices on Performance of Public Secondary Schools in KCSE**

The study sought to show the influence of procurement of ICT devices on performance of public secondary schools in KCSE. The study revealed that any unit increase in procurement of ICT devices would lead to 0.410 change in performance of public secondary schools in KCSE. The study also revealed that government funding for procurement of ICT devices with a mean of 3.62, additional funding for procurement of ICT devices with a mean of 3.68 and funding policy for procurement of ICT devices with a mean of 3.49 influence performance in public secondary schools in KCSE.

### **5.3 Discussions of the findings**

The study discussed the findings alongside empirical review of literature.

#### **5.3.1 ICT infrastructure on performance of public secondary schools in KCSE**

The study found that ICT infrastructure influences performance of public secondary schools in KCSE with a positive moderate correlation. The study revealed that ICT infrastructure that includes the access to laptops, access to broadband, learning facilities and special needs facilities influence performance of public secondary schools in KCSE. This is supported by Karimi (2011) who found a strong relationship between the availability of ICT infrastructure and learners' performance in KCSE.

#### **5.3.2 Development of digital content on Performance of Public Secondary Schools in KCSE**

The study findings on the development of digital content was found to influence performance of public secondary schools in KCSE with a positive weak correlation. In reference to the predictor variables: digital content and resources, computer aided instructions, digital learning materials and digital content transmission, development of digital content influences performance of public secondary schools in KCSE. Mo et al. (2014) support this finding as they found that academic scores slightly increased with the use of digitalized education content.

### **5.3.3 Capacity building of teachers on Performance of Public Secondary Schools in KCSE**

The study found out capacity building of teachers influences the performance of public secondary schools in KCSE with a positive weak correlation. The conclusion was that any changes in capacity building which is an independent variable influenced the changes in the performance of public secondary schools which is the dependent variable. Further, these conclusions indicated that in-service education and training, pre-services teacher education and administration and school heads training influence the performance of public secondary schools in KCSE. This finding concurs with Cooter (2003) who found that the capacity building in ICT integration is significant in determining the learners' performance.

### **5.3.4 Procurement of ICT devices on Performance of Public Secondary Schools in KCSE**

The study found out that procurement of ICT devices influences the performance of public secondary schools in KCSE with a positive moderate correlation. From the study findings, it was established that the government funding, additional funding, frequency of funding and government funding policy influenced the performance of public secondary schools in KCSE. The findings are like those of Penszko and Zielonka (2013) which concluded that the procurement of ICT devices showed a minimal significant improvement on the learners' performance.

## **5.4 Conclusion of the Findings**

From the first objective on ICT integration projects concluded that the access to laptops, access to broadband, learning facilities and special needs facilities influence the performance of public secondary schools in KCSE in Kiambu County, Kenya.

The second objective on the development of digital content indicated that digital content and resources, computer aided instruction, digital learning material and digital content transmission influences the performance of public secondary schools in KCSE in Kiambu County, Kenya.

Objective three of the study on the capacity building of teachers indicated that in services education and training, pre-services teacher education and school head training influence the performance of public secondary schools in KCSE in Kiambu County, Kenya.

Finally, the fourth objective on procurement of ICT devices indicated that government funding, additional funding, frequency of funding and government funding policy influence the performance of public secondary schools in KCSE in Kiambu County, Kenya.

### **5.5 Recommendations**

The study made the following recommendations

1. Public secondary schools should be adequately equipped with more ICT infrastructure to aid in the improvement of KCSE performance.
2. There is a need to digitize classroom content to simplify instruction and improve accessibility of learning material to improve KCSE performance.
3. The Kenya Institute of Curriculum Development should increase capacity development and support to schools to enhance KCSE performance.
4. The government should allocate more funds for the procurement of ICT devices through considering the amount of money allocated to schools to improve KCSE performance.

### **5.6 Suggestions for Further Research**

The study recommends further research on the following areas;

The study recommends further research on the following areas;

1. Influence of ICT integration projects on the new curriculum goals of public secondary schools in KCSE.
2. The role of ICT in determining the transition rates to tertiary institutions in public secondary schools.

## REFERENCES

- Abbott, S. C. (2010). *A New Era of Leadership: Preparing Leaders for Urban Schools & the 21st Century*. ProQuest LLC. 789 East Eisenhower Parkway, P.O. Box 1346, Ann Arbor, MI 48106. Tel: 800-521-0600; Web site: <http://www.proquest.com/en-US/products/dissertations/individuals.shtml>.
- Aesaert, K., Vanderlinde, R., Tondeur, J., & van, B. J. (2013). The content of educational technology curricula: a cross-curricular state of the art. *Educational Technology Research and Development*, 61, 1, 131-151.
- Al- Ansari, H. (2006). Internet use by the faculty members of Kuwait University. *The Electronic Library*, 24, 6, 791-803.
- Amadalo, M.M, Sulungai, M.W, & Toili, W.W. (2012). Teacher Related Factors influencing integration of ICT in Teaching of Mathematics in Secondary schools in Kenya. *African Journal of Education and Technology*, 1-14.
- Areti, V., & Makridou-Bousiou, D. (2006). Satisfying distance education students of the Hellenic Open University. *E-mentor*, 2006, 80-85.
- Aristovnik, A. (2012). *The impact of ICT on educational performance and its efficiency in selected EU and OECD countries: A non-parametric analysis*. (TOJET, 11, 3, 144-152.)
- Association of African Universities. (2000). *A study on private universities in Africa*. Accra: Association of African Universities.
- Balanskat, A., Blamire, R., Kefala, S., & European Schoolnet. (2006). *The ICT Impact Report: A review of studies of ICT impact on schools in Europe*. European Communities.
- Bennett, N., & Dunne, E. (1997). The Nature and Quality of Talk in Co-Operative Classroom Groups. *Learning and Instruction*, 1, 2, 103-18.
- Bridgeman, B., Ervin, N., Jenkins, L., College Entrance Examination Board. & Educational Testing Service. (2000). *Predictions of freshman grade-point average from the revised and re-centered SAT I, Reasoning Test*.

- Buabeng-Andoh, C., & Issifu, Y. (2015). Implementation of ICT in Learning: A Study of Students in Ghanaian Secondary Schools. *Procedia - Social and Behavioral Sciences, 191*, 1282-1287.
- Canuel, R. (2006). PROMISING PRACTICES - One Student: One Laptop. *Education Canada, 37*.
- Committee on Developments in the Science of Learning with additional material from the Committee on Learning Research and Educational Practice, National Research Council. (2000). *How People Learn: Brain, Mind, Experience, and School: Expanded Edition*. National Academies Press.
- Cooter, R. B. (2003). Teacher "capacity-building" helps urban children succeed in reading. *Reading Teacher, 57*, 198-205.
- Darling-Hammond, L., Bransford, J., LePage, Hammerness, K., & Duffy, H. (2005). *Preparing teachers for a changing world: What teachers should learn and be able to do*.
- Delen, E., & Bulut, O. (2011). The relationship between learners' exposure to technology and their achievement in science and math. *Turkish Online Journal of Educational Technology, 10*, 3, 311-317.
- Emmons, J. G. (2000). *Twelfth-graders respond to Macbeth: A response-based approach through student-led discussion in a secondary classroom*.
- Evoh, C. J. (2010). ICT in Education Development in Africa.
- Fakrudeen, Mohammed, Miraz, Mahdi H., & Excell, Peter. (2017). *Success Criteria For Implementing Technology in Special Education: a Case Study*.
- Fu, J. S. (2013). ICT in Education: A Critical Literature Review and Its Implications. *International Journal of Education and Development Using Information and Communication Technology, 9*, 1, 112-125.
- Gachinu, G. J. (2014). Influence of ICT Integration on Performance in Mathematics in Public Secondary Schools in Embu North District of Kenya. Unpublished Masters Project. Department of Educational Geography and Environmental Studies University of Nairobi.



- Geoffrey, O (2010). Effects of Information and Communication Technology On Students' Learning: A Case of Gulu University.
- Gess-Newsome, J., Southerland, S. A., Johnston, A., & Woodbury, S. (2003). Educational Reform, Personal Practical Theories, and Dissatisfaction: The Anatomy of Change in College Science Teaching. *American Educational Research Journal*, 40, 3, 731-767.
- Grimes, A., Townsend, W., & Motu Economic and Public Policy Research Trust. (2017). *The effect of fibre broadband on student learning*.
- Gui, M., Parma, A., & Comi, S. (June 01, 2018). Does Public Investment in ICTs Improve Learning Performance? Evidence from Italy. *Policy & Internet*, 10, 2, 141-163.
- Higgins, S., Beauchamp, G., & Miller, D. (2007). Reviewing the literature on interactive whiteboards. *Learning, Media and Technology*, 32, 3, 213-225.
- Holcomb, L.B. (2009). Results and lessons learned from 1:1 Laptop Initiatives: A collective review. *TechTrends*, 53(6), 49-55.
- Hyland, Marie, Layte, Richard, Lyons, Sean, McCoy, Selina, & Silles, Mary. (2013). *Are classroom internet use and academic performance higher after government broadband subsidies to primary schools?*. (24th European Regional Conference of the International Telecommunication Society, Florence, Italy, 20-23 October 2013.) ITS Florence.
- ICT Authority. (2016). Digital Literacy Programme Progress. Retrieved from: <http://icta.go.ke/digital-literacy-programme-progress-may-2016/>
- Ikwuka, O.I. (2010). *Development and validation of audio and video instructional packages for teaching oral English in senior schools in Minna, Nigeria*. Unpublished Ph.D. Dissertation, Department of Science Education, University of Ilorin, Ilorin.
- International Labor Organization. (2003). *Learning and training for work in the knowledge society, the constituents' views*. Geneva: ILO.
- Japan International Corporation Agency. (2014). *JICA annual report: Japan International Cooperation Agency annual report*. Japan: Takayama Printing Co. Ltd.
- Kadiri, B.M. (2015). *Teacher-Based Factors Influencing Integration of Information Communication Technology in Teaching of English Language in Public Secondary*

- Schools in Vihiga Sub-County, Kenya*, Unpublished master dissertation, University of Nairobi, Kenya.
- Karimi, N.M. (2011). *School Based factors affecting performance of students in KCSE in public day secondary schools in Mathioya District- Kenya*, Unpublished master dissertation, University of Nairobi, Kenya.
- Kenya. & Kenya. (2008). *Sector plan for education and training 2008-2012*. Nairobi: Ministry of State for Planning, National Development, and Vision 2030.
- Kirschner P.A. & Davis, N.E. (2003) Pedagogic Benchmarks for Information and Communications Technology in Teacher Education, *Technology, Pedagogy and Education*, 12, 127-149.
- Machin, S., McNally, S., & Silva, O. (2007). New Technology in Schools: Is There a Payoff?. *The Economic Journal*, 117, 522, 1145-1167.
- Mbwesa, J. (2002). A Survey of students' perception and utilization of the web as a learning resource: A Case Study of Department of Extra Mural Studies, an unpublished master dissertation, University of Nairobi, Kenya.
- Mingaine, L. (January 01, 2013). Leadership Challenges in the Implementation of ICT in Public Secondary Schools, Kenya. *Journal of Education and Learning*, 2, 1, 32-43.
- MOEST. (2005). *Sessional paper no. 1 of 2005 on a policy framework for education, training and research*.
- Mononen-Aaltonen, M. (2008). A Learning Environment - A Euphemism for Instruction or a Potential for Dialogue? Media Education Publication, pp. 163-212.
- Mouza, C. (2008). Learning with Laptops: Implementation and Outcomes in an Urban, Under-Privileged School. *Journal of Research on Technology in Education*, 40, 4, 447-474.
- Mwangi, M.W. (2011). *School based factors' influence on students' performance in Kenya Certificate of Secondary Education in Murang'a South District, Kenya*, Unpublished master dissertation, University of Nairobi, Kenya.
- Mwiluli, P.M. (2018). *Influence of ICT integration on academic performance in public secondary schools in Kenya. A case of Makeni County*, Unpublished master dissertation, University of Nairobi, Kenya.

- Ng, S. H. S. (2017). Slate-Enabled Literacy Practices in a Futureschool@Singapore Classroom.
- Nketiah-Amponsah, E., Asamoah, M. K., Allassani, W., & Aziale, L. K. (December 01, 2017). Examining students' experience with the use of some selected ICT devices and applications for learning and their effect on academic performance. *Journal of Computers in Education*, 4, 4, 441-460.
- Noroozi, O., Busstra, M. C., Mulder, M., Biemans, H. J. A., Tobi, H., Geelen, M. M. E. E., Chizari, M. (2012). Online discussion compensates for suboptimal timing of supportive information presentation in a digitally supported learning environment. *Educational Technology Research and Development*, 60, 193–221. <http://dx.doi.org/10.1007/s11423-011-9217-2>
- Ogembo, J. G., Ngugi, B., & Pelowski, M. (, 2012). Computerizing Primary Schools in Rural Kenya: Outstanding Challenges and Possible Solutions. *The Electronic Journal of Information Systems in Developing Countries*, 52, 1, 1-17.
- Olaofe, I. A. (2005). Nigerian educational emancipation: roadmap from crisis to resurgence. *Faculty of Education Seminar Series*, No. 1. Ahmadu Bello University, Zaria.
- Oliver, R. (2002). *The role of ICT in higher education for the 21th century: ICT as a change agent for education*. Edith Cowan University. Western Australia.
- Omusonga, TO, Kazadi, IM, & Indoshi, FC. (2009). *Relationship between school culture and students' performance in French in selected secondary schools in Kenya*. (Journal of Language, Technology & Entrepreneurship in Africa; Vol 1, No 2 (2009); 255-263.) United States International University (USIU).
- Organisation for Economic Co-operation and Development (OECD). & Teaching and Learning International Survey. (2009). *Creating effective teaching and learning environments: First results from TALIS*. Paris: OECD, Teaching and Learning International Survey.
- Otiang'a, Ruth & Ayere, Mildred & Rabari, J. (2019). Influence of integration of information communication technology on performance in Chemistry among public secondary schools in Kisumu County, Kenya. 6. 93 - 110.
- Robert B. Kozma. (January 01, 2005). National Policies that Connect ICT-Based Education Reform to Economic and Social Development. *Human Technology: an Interdisciplinary Journal on Humans in Ict Environments*, 1, 2, 117-156.

- Rogers, E. (2003). *Diffusion of innovations* (5th ed.). New York, NY: The Free Press.
- Saqib Khan, Muhammad & Khan, Irfan & U-Din, Siraj & Muhammad, Hafiz & Khattak, Rafid & Jan, Rahimullah. (2015). The impacts of ICT on the students' Performance: A Review of Access to Information. 5. 2225-484.
- Sauers, N. J., & Mcleod, S. (2012). *What does the research say about school One-to-one computing initiatives?* Center for the Advanced Study of Technology Leadership in Education, University of Kentucky.
- Scholars Strategy Network (2014). Digital tools in K-12 classrooms and learner achievement: Weighing the evidence. *Scholars Strategy Network*.
- Selwyn, N. (2007). The use of computer technology in university teaching and learning: a critical perspective: A critical look at computer use in higher education. *Journal of Computer Assisted Learning*, 23, 2, 83-94.
- Slava Kalyuga, & Tzu-Chien Liu. (2015). Guest Editorial: Managing Cognitive Load in Technology-Based Learning Environments. *Journal of Educational Technology & Society*, 18(4), 1-8.
- Tanui, M., (2013) *Principals' Role In Promoting Use and Integration Of Information and Communication Technology In Public Secondary Schools In Wareng Sub-County, Kenya*, Unpublished Master's thesis, Catholic University of East Africa.
- Tay, L. Y., Melwani, M., Ong, J. L., & Ng, K. R. (2017). A case study of designing technology-enhanced learning in an elementary school in Singapore. *Learning: Research and Practice*, 3, 2, 98-113.
- Tedla, B. A. (2012). Understanding the importance, impacts and barriers of ICT on Teaching and Learning in East African Countries. *International Journal for E-Learning Security*, 2, 2, 199-207.
- UNESCO (United Nations Educational, Scientific and Cultural Organization) (2014), *Reading in the Mobile Era. A Study of Mobile Reading in Developing Countries*, Paris.
- Unwin, T. (2009). *ICT4D: Information and communication technology for development*. Cambridge: Cambridge University Press.

Weston, M. E., & Bain, A. (2010). The End of Techno-Critique: The Naked Truth about 1:1 Laptop Initiatives and Educational Change. *Journal of Technology, Learning, and Assessment*, 9, 6.)

Zwart, D. P., Van, L. J. E. H., Noroozi, O., & Goei, S. L. (January 01, 2017). The effects of digital learning material on students' mathematics learning in vocational education. *Cogent Arts & Humanities*, 4, 1-10.

## APPENDICES

### Appendix I: Letter of Transmittal

NDUNG’U ZIPPORAH WATIRI,

P.O BOX 30197-00100

Nairobi.

October 15, 2019.

Dear Respondent

**RE: LETTER FOR DATA COLLECTION**

I am a learner pursuing Master of Arts degree in Project Planning and Management in the University of Nairobi. As part of the requirement for the award of the degree, I am undertaking a research study on ‘*Influence of Information Communication and Technology Integration Projects on The Performance of Public Secondary Schools in KCSE In Kiambu County, Kenya*. I therefore request your assistance in completing the questionnaires attached. Kindly answer all the questions truthfully.

The research results will be used for academic purposes only and will be treated with confidentiality. Only a summary of the results will be made public. Your cooperation is highly appreciated.

Yours sincerely,

Ndung’u Zipporah Watiri

L50/5291/2017

Tel: +254 727 731 936

Email: [zippiewambu@gmail.com](mailto:zippiewambu@gmail.com)

## Appendix II: Questionnaire

This questionnaire is designed to collect information on the influence of ICT Integration Projects on The Performance of Public Secondary Schools in KCSE in Kiambu County, Kenya. Kindly take your time to answer the questions as honestly and truthfully as possible.

The information collected in this questionnaire will be used for the intended purpose and therefore any information or responses given will be confidential.

### Section A: Demographic Characteristics of the Respondents

Kindly fill in the information as directed in the various sections provided

1. Kindly indicate your gender. {Please tick one (✓)}

Male [ ]                      Female [ ]

2. What is your highest level of education?

i. Diploma college [ ]

ii. Bachelors' degree [ ]

iii. Post Graduate Diploma [ ]

iv. Masters' degree [ ]

v. PhD. [ ]

3. How long have you used ICT in this school?

i. Less than 1 year [ ]

ii. 1 – 2 years [ ]

iii. 3 – 4 years [ ]

iv. Above 5 years [ ]

**PART II: ICT INTEGRATION AND PERFORMANCE IN PUBLIC  
SECONDARY SCHOOLS IN KCSE**

Please give your opinion to the extent you agree with the following statement using a Likert scale of 1-5 where 1=Strongly Disagree (SD), 2= Disagree (D), 3= Neutral (N), 4= Agree (A) and 5= Strongly Agree (SA)

**Section B: ICT Infrastructure**

1. Please give your opinion on the extent to which you agree with the following statement using a Likert Scale of 1 – 5 regarding ICT integration.

<b>Statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Access to Laptops/Tablets influences performance in public secondary schools in KCSE.					
Access to broadband influences performance in public secondary schools in KCSE.					
Learning facilities influence performance in public secondary schools in KCSE.					
Special needs facilities influence performance in public secondary schools in KCSE					



**Section C: Development of Digital Content**

2. Please give your opinion on the extent to which you agree with the following statement using a Likert Scale of 1 – 5 regarding development of digital content.

<b>Statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Digital content and resources influence performance in public secondary schools in KCSE					
Computer aided instruction influences performance in public secondary schools in KCSE					
Digital learning materials influence performance in public secondary schools in KCSE					
Digital content transmission influences performance in public secondary schools in KCSE					

**Section D: Capacity Building of Teachers**

3. Please give your opinion on the extent to which you agree with the following statement using a Likert Scale of 1 – 5 regarding capacity building of teachers.

<b>Statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
In service education and training influences performance in public secondary schools in KCSE					
Pre-service teacher education influences performance in public secondary schools in KCSE					
School heads training influences performance in public secondary schools in KCSE					

**Section E: Procurement of ICT Devices**

4. Please give your opinion on the extent to which you agree with the following statements using a Likert scale of 1 – 5 regarding the procurement of ICT devices.

<b>Statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Government funding for procurement of ICT devices influences performance in public secondary schools in KCSE					
Additional funding for procurement of ICT devices influences performance in public secondary schools in KCSE					
Frequency of funding for procurement of ICT devices influences performance in public secondary schools in KCSE					
Government funding policy for procurement of ICT devices influences performance in public secondary schools in KCSE					

**Section F: Performance of public secondary schools in KCSE in Kiambu County**

5. Please give your opinion on the extent to which you agree with the following statements using a Likert scale of 1 – 5 regarding the procurement of ICT devices.

<b>Statements</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Commitment to academic performance influences performance in public secondary schools in KCSE					
Involvement of stakeholders and the community influences performance in public secondary schools in KCSE					
Overall mean score in the KCSE results in recent years (5 Years) is commendable					
Rate of learner’s admission to tertiary learning institutions is considerable					

**Thank You.**