Constraints of Effective Usage of ICT by Students for Learning in Slum Areas in Nairobi, Kenya: A Case of Kangemi Ward, Nairobi

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Abstract: *ICT has become the face of innovation and is defining the future of the world economy and generations. ICT is used in various sectors of the economy such as agriculture and education. The education sector in particular has seen the rise of innovative technologies that are widely used throughout the world. These include projector screens, smart–boards, and most importantly, computers. ICT usage in schools within African countries such as Kenya is slower compared to western countries especially in schools located in slums. Kangemi is one the slums in Kenya and this is where this study will focus on as a case study. Slum areas have unique constraints affecting the availability and usage of computers by school-going children. This research focused on Kangemi Ward within Kangemi slum. The research goals were to identify these constraints that Kangemi was facing. Through field data that was collected, the researcher observed that cost of computers, availability and reliability of electricity, and financial status' of residents of Kangemi were some of the notable constraints faced. However, not all of these constraints provided a positive correlation with access to computers by school-going children in Kangemi both at home and in school. Most of the data was analysed descriptively and both quantitative and qualitative methods of analysis were employed.*

Keywords: ICT, Constraints, MPESA

1. Introduction

1.1. Background

ICT or Information Communications Technology can be described as an 'umbrella' term that describes every appliance that uses technology including telecommunications (FOLDOC, 2008). ICT in today's society is becoming increasingly prominent. Most forms of communication, data storage and even entertainment are being displayed via ICT. Almost all countries in the world today have some sort of access to ICT as shown by a study conducted in 2016 by ITU that showed that almost all 7 billion people have access to 2G connectivity (ITU, 2016).

Aside from just telecom communication, there have been several technological platforms that have come from the prominence of ICT. There are now applications that can be downloaded from a server and used for various functions such as gaming, transport, and vacation. There are also more complex and interesting ICT powered forms of communication besides email. For instance, there has been widespread use of social media platforms such as Facebook and Snapchat which are completely different from each other, yet have attracted hundreds of millions of users. A study by Statista (2017) showed that Facebook on its own has 1.788 billion monthly users while Snapchat has more than 8 billion mobile videos played every day. These figures are staggering and clearly show how important ICT has become.

Education has also been affected by the rise of the importance of ICT. Various technologies such as smart-boards and projectors have become increasingly useful in the lives of many students around the world. ICT is heavily used in education for several purposes. For instance, teachers use ICT to teach with presentations and to demonstrate processes in front of students.

Without the use of ICT, examinations would be difficult to make because the papers are drafted using programs that are ICT. Furthermore, a large number of assignments are nowadays being assigned online. Research projects and other such assignments require citations which are mostly available online. ICT is also used to store data. Past examinations, transcripts, and other scholarly items are mostly stored using ICT. Lastly, students use social media to interact among themselves with each other.

Kenya had not adequately adopted ICT in most of sectors of the economy prior to the formation of the ICT Authority in 2013 (ICT Authority, 2017). However with the inclusion of ICT, since 2013, Kenya's economy has grown significantly. It's on record that between 2013 and 2014, there was a growth of 8.4 percent in the ICT sector, and in 2015, the ICT sector was worth Sh138 billion (Ogotu, 2015). Additionally, studies show that Kenya's economy with ICT has grown at an average of 3.7%, but without ICT, the growth would have been at 2.8% (Ogotu, 2015). During the first decade of the 21st century, ICT was responsible for the growth of approximately one quarter of Kenya's GDP (Ogotu, 2015).

In Kenya, the distribution of ICT in public education is also unequal. Most of the ICT available is used in tertiary education, and hardly used in primary and secondary public schools. Secondly, most of the ICT available in Kenya are mobile telephony and internet access (Kabura, 2012). There are inadequate projectors or smart boards that could help aid learning in Kenya. The computers that are available are also mostly used by teachers to create national examinations and store other documents. The students themselves rarely have a chance to learn how to use the equipment. There is a government project now however, that aims to provide

laptops to first grade students so that the younger generation gets more familiar with the ICT technology (Wainaina, 2016).

The information mentioned above clearly shows that ICT is important to modern day learners. Without the knowledge of ICT, modern day students would have difficulty in adapting to careers present in the world today. As the hunger for knowledge grows, more and more technology is needed better the conditions we as humans live in, and to keep bypassing boundaries in science. Nowadays, most careers are centered either on new technological advancements or the application of these technologies towards different feats. If Kenyan children get access to ICT, then there is a higher chance of them finding jobs, becoming more literate, and they would also contribute more to the world.

1.2. Problem Statement

ICT has become necessary in today's world economies. For stable careers, people need some sort of background/familiarity with ICT, and the world market is being flooded with different technological items. People are communicating with each other using social media and extremely large amounts of data are being stored every day. Massive social media pages and franchises such as Snapchat and Facebook are storing thousands of gigabytes of data every day as people keep updating their social lives.

One can therefore see that ICT is extremely important based on the reasons mentioned above. However, in Kenya, not everyone has access to ICT. In Kenya, the ICT available is mostly mobile telecom access as its mobile penetration hit 88% (C.A.K, 2017), but not everyone has access to internet, nor do many have access to laptops and other forms of ICT. However, those who do have access to ICT are using it effectively. Outreaches such as MPesa have become increasingly popular, and most people are using this program to transfer and withdraw money. ICT as mentioned above is very important to the careers of the youth. However, since Kenya does not have complete access to ICT, much of its youth's potential could go to waste.

In Kenya, computers are used in schools mainly for academic purposes. However, there is unequal distribution of computers as not all schools have access to them. This unequal distribution can be attributed to constraints. The constraints differ depending on factors such as demography, economic status and population. Slum areas such as Kangemi in Nairobi, Kenya, are exposed to most of these constraints, as compared to other more affluent areas. There is need to therefore investigate the constraints that would inhibit students access to computers especially in such slum areas.

1.3. Objectives

i) To investigate the availability of Computers and other ICT equipment and the extent of their usage in schools in Kangemi ward, Nairobi County.
ii) To assess the availability of computers and other ICT equipment in households based in Kangemi ward, Nairobi County.

iii) To assess the extent at which electricity availability and reliability affects use of ICT by students in Kangemi ward, Nairobi County.
iv) To investigate how the cost of ICT equipment such as computers affects the extent of their usage in learning in Kangemi ward, Nairobi County.

1.4. Research questions

i) Are schools in Kangemi ward, Nairobi County well equipped with necessary ICT equipment such as computers and to what extent are they being used in learning?
ii) Do students in Kangemi ward, Nairobi County, have access to ICT equipment such as computers at home?
iii) To what extent is the use of ICT equipment such as computers by students in Kangemi, Nairobi County affected by electricity availability and reliability?
iv) How does the cost of ICT equipment such as computers affect the extent of their usage in schools in Kangemi, Nairobi County?

1.5. Scope of Study

The study focused on usage of computers in Kangemi Ward, Nairobi County. This provided good information on computer availability and usage in slum areas within Kenya. Primary focus was on students at primary and secondary levels of study. This was based on the fact that most tertiary institutions are not based in slum areas and indeed most of them are already using computers.

The research limited itself to children's access to computers both at home and at school. This is because these are the main areas where school-going children would normally access computers. The constraints that slum areas such as Kangemi face are diverse hence the study narrowed down to a few of them. These are: Reliability of electricity connections at home, cost of computers in Kenya and the monthly income of parents whose children attend school in Kangemi.

1.6. Significance of Study

ICT is being used almost everywhere around the world in today's day and age. People communicate with others who are far away, health is becoming increasingly technologically oriented, and transport has advanced from simply walking to the airplane. ICT is also being used to communicate with friends and family who are far away from each other. A great example of this is social media, which is being used by hundreds of millions of people every day. All in all, ICT has become essential in the society that we live in today.

Thus, the use of ICT in education is required, as the familiarity towards newer technology would result in a higher learning capacity and also in a more informed youth. This gives everyone a chance to prove their worth in the grand scheme of things and to try help improve the conditions we live in right now. Also, jobs available on the planet today are very centered on technology. The inclusion of ICT will therefore, as mentioned above prepare the youth

for the future and also give them a better background so that they can be successful in their careers. Teachers who use these technologies would also make their lectures much more interesting, which would result in the students retaining more.

Identifying constraints that inhibit faster growth of technology in education in Kenya especially provision of computers is one step into solving the problem. It would also be beneficial to particularly identify constraints for slum areas such as Kangemi since they face more of these constraints. Challenges in accessing social amenities in slums as well as low income levels of residents need to be established so as to create proper solutions.

2. Literature Review

2.1 Introduction

There are three sections addressed in this chapter including review of the usage of ICT in the world (analysed as a world view), an in-depth analysis of use of ICT in an African context, and a detailed review of the usage of ICT in Kenya with a special focus on Nairobi County. Information is gathered from the past studies on the topic.

2.2 Evolution of ICT in Education

2.2.1 A World View
Technology has become one of the key unifying factors for all the people across the globe. The use of ICT has gained traction the world over with ICT being used in different spheres of life. One of the fields that has greatly benefited from adoption of ICT in the world is the field of education (Jhurreev, 2005).

Technological infrastructure has for a long time been the main factor affecting the growth and usage of ICT in education in the world. However, even with technological advancements, there is need for policy makers to create relevant policies that would enable ICT to be used in education. Policy makers are usually well placed to bring about change in the education sector using ICT. This can be confirmed in the study of (Kozma, 2003) in which 28 countries that had used different policies in implementing the use of ICT in education were analysed. Kozma (2003) established a positive correlation between good policies and the successful implementation of ICT in education.

2.2.2 An African View
Most countries in the African continent can be classified as developing. This can be attributed to the fact that most aspects of African economies are still at the stage where they are experiencing exponential growth. They have not reached their pinnacle since there is room for growth so as to attain heights reached by first world countries. Calderisi (2006) posits that the rate of economic growth in all sectors of African economies is in the destiny of African countries themselves. Calderisi (2006) argued that proper policies can be put in place to boost development of sectors such as education which would in turn translate into growth of other sectors. African has recorded milestones in developing and

adopting ICT in its sectors though there are more strides to be made.

The ICT skills in Africa are in great demand especially in such areas as education, governance, business and commerce (World Bank, 2004). Computers in particular have been the key reason for improved learning in schools, creation of employment opportunities and increased productivity across Africa in recent times (Okumbe 2001). Different levels of education in Africa have had increased use of computers in a bid to improve their education standards. Universities and colleges were some of the first institutions to start using ICT in education in Africa. Primary and secondary schools are gradually adopting computer technology in teaching and other instructional activities. Computer skills are also taught in some curricula. For instance, in South Africa, almost all schools have access to ICT although the extent of penetration and usage differs from one school to the other as well as from one geographical area to the other. Table 2.1 below shows the penetration of computers in South African schools by 2005. This illustrates how early South African schools were able to get access to computers within their curriculum.

Table 2.1: Penetration of Computers in South African Schools by Year 2005

Province	Total Number of Schools	% Schools with Computers*	% Schools with Computers for Teaching and Learning*
Eastern Cape	6,239	23.0	7.8
Free State	1,842	77.3	25.9
Gauteng	1,897	94.5	78.8
Kwazulu Natal	5,653	43.6	12.0
Mpumulanga	1,863	52.9	16.3
Northern Cape	422	91.0	60.4
Limpopo	4,187	41.8	8.7
North West	2,025	67.6	29.7
Western Cape	1,454	97.0	76.6
National	25,582	50.9	22.6

*Percentage figures have been rounded to the nearest decimal point.

Source: Survey of ICT and Education in Africa: South Africa County Report

As can be observed in table 2.0 above, the percentage penetration of computers into different provinces of South Africa varies. While some provinces such as Gauteng have a high percentage of schools with computers being used for teaching and learning, others such as Eastern Cape have a very low percentage. This is a clear indication that there are factors that affect the availability and usage of computers in South Africa, a fact that can be extrapolated to imply the same for the rest of Africa.

Penetration of ICT in African schools is usually lagged by several factors which may be related to the economic situation of the country. Prah (2002) admits the existence of such hindering factors though proceeds to state that they can be solved with proper policy making. Calderisi (2006) suggests that constraints facing ICT in education in Africa are African problems that require African solutions.

2.2.3 A Kenyan View

Basic infrastructure is vital in the implementation of e-learning in schools the world over (World Bank, 2006). The World Bank report also posits that basic infrastructure as well as schemes and policies can either empower or constrain the implementation of usage of ICT in education. Kenya, being a developing country in Africa is still in the process of having a fully-fledged infrastructural network for ICT usage in all levels of education.

Several e-learning platforms exist in Kenya though they neither cover the entire nation nor all education cadres. However, there are constraints related to access of ICT in education in Kenya. ICT equipment requires several infrastructural capacities such as electricity so as to successfully operate. Most parts of Kenya do have access to electricity though the same developmental infrastructure is yet to cover all parts of the country. Innovative ways of solving such problems of infrastructure should be put in place (Gunda and Ricketts, 2006). The use of solar energy to power ICT equipment would help in reducing constraints related to electricity (Gunda and Ricketts, 2006).

Amutabi (2004) observed that ever since the 1980's and 1990's, integration of ICT in education has been compulsory in developed nations. This has not been the case in most developing countries such as Kenya. This explains why most developed countries already use ICT in almost all spheres of their academic institutions. To merge this gap, USAID in conjunction with the Government of Kenya facilitated a team of consultants to evaluate possible options that the ministry of education could use to ensure that ICT would be fully integrated into the Kenyan education system.

Mugenda (2006) posits that one of the biggest challenges in the use of ICT in education is balancing educational goals with economic realities of a country. This clearly suggests that the adoption of computers and other ICT equipment should be done bearing in mind the country's economic situation at the time. This would cushion the ICT initiative in future since it requires other supportive factors to be implemented and operate smoothly.

2.4 Conceptual framework

Complete integration of ICT in schools in Kenya needs to be fully achieved but its full implementation has not been achieved yet due to several constraints. In the context of Kangemi Ward, Nairobi County in Kenya, the constraints are unique bearing in mind that Kangemi happens to be a slum. School-going children in Kangemi can access computers from school or from home. In both of these situations the constraints of access to computers would still be a challenge.

Does cost of computers affect access and use of computers by student at home and at school? Aspects such as cost of computers, electricity connectivity and reliability as well as financial ability of parents need further investigation and analysis so as to know the extent with which they may or may not affect access and usage of computers by school-going children in Kangemi both at school and at home. In this regard, the conceptual framework below guided this research project
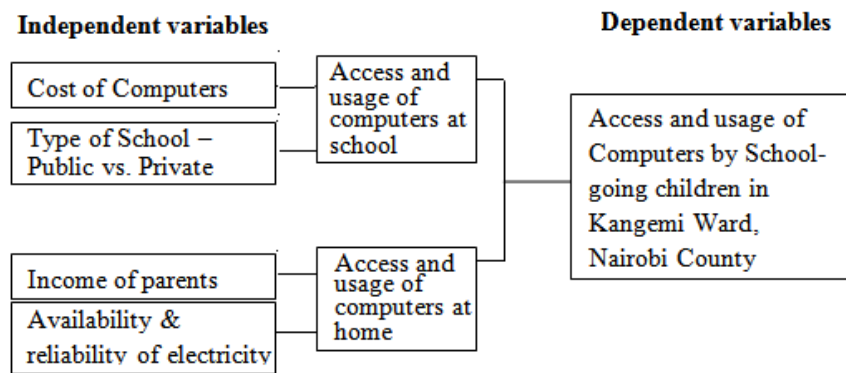
Figure 2.1: Conceptual framework

3. Research Methodology

3.0 Introduction

This chapter focuses on the research methods and procedures that will be used in the undertaking of this study. It covers the areas of research design, population, sampling design, data collection methods, research procedures, data analysis methods, sample size and eventually a chapter summary giving an overview of the entire chapter.

3.1 Research Design

Hedges (2009), defines research design as the organization of data collection strategies so that the data collected can result in an unambiguous conclusion.

The study adopted descriptive research design. According to Cooper and Schindler (2001), a descriptive study discovers relationships between different variables, and either clearly states hypotheses or objectives for these discoveries. Descriptive research outlines the attitudes, progress and general feeling of people. Accuracy is well achieved using descriptive research. Measures of central tendencies were then used to carry out statistical analysis since frequencies

can be calculated. This type of research attempts to describe such things as possible behaviours, attitudes, values, and characteristics (Mugenda & Mugenda, 2003).

Both qualitative and quantitative techniques were used in this research study. The quantitative techniques were used in analysing results of quantifiable measures like the financials of parents, while the qualitative technique was used in analysing the unquantifiable contexts of the findings such as emotions expressed.

3.2 Population and Sample Size

Mugenda and Mugenda (2003) define populations as sets of people, or items that have similar characteristics that can be observed. The population in this study involved parents with school-going children in Kangemi Slums, Nairobi County and also those who live in Kangemi. A sample of 101 respondents was used in the study. A sample size of 101 respondents was selected based on Adler and Adler's (1987) concept of sampling that the sample should not be too small to fail to be a representative of the population or too large to spend large amounts of time to collect data since time and cost are of essence in research.

3.3 Sampling Design

A sample survey is a technique of representing a large group of people by studying a small portion of that group. Sampling allows for fewer errors to be made during analysis of data as compared to analysing an entire population. Furthermore, sampling costs less, saves time, and provides administrative convenience (Kothari, 2004). Simple random sampling technique was used in this study to select 101 respondents. The technique gives each person in the population equal chances of being selected (Kothari, 2004).

3.4 Sample Selection

The data used was purely primary data collected only in the field from the target population which was the parents of school-going children in Kangemi Ward, Nairobi County. Primary data enables one to draw conclusions from the data since it comes directly from the target population. (Mugenda & Mugenda, 2003)

3.5 Data type and collection

The research used primary data collected using questionnaire method. According to Mugenda and Mugenda (2003) primary data refers to information that a researcher gathers from the field. Close-ended questionnaire was used and questions were Likert-scaled. The questionnaires were administered to the respondents to fill-in and then collected for organization and analysis.

3.6 Data Analysis

Data analysis was conducted both quantitatively and qualitatively. Quantitative data was inputted into quantitative analysis software, in this case IBM SPSS Statistics v.24. Qualitative data like sentiments or statements on feedbacks by customers was translated into quantitative

judgments based on number reviews, and was also fed into the same IBM SPSS Statistics v.24. Analysed data was presented using graphs, charts, and tables. Specifically, Pie Charts, Bar Graphs, and Statistical ANOVA Tables were used in data presentation.

3.7 Ethical Considerations

According to Ellsberg and Heise (2005), "Research designs should consider issues of confidentiality, problems of disclosure, and the need to ensure adequate and informed consent". The ethical principles of confidentiality and respect are especially relevant in the collection of data in the field, as people are sensitive about giving information on their personal lives. These include their financial status as well as their living conditions. The respondents in this study were over 18 years of age and the information collected from them was treated as confidential and they were guaranteed that it will be used for the study only.

4. Presentation of Findings

4.1 Introduction

This chapter contains diagrammatic representations and analysis of all the findings that emanated from the research tool which was the questionnaire. Data presentation has been portrayed using charts, graphs and tables.

4.2 Type of School that the Child Attends – Private vs. Public

As depicted by figure 4.1 below, most of the school-going children in Kangemi attend public schools at 55.45%. The minority representing 44.55% attends private schools.
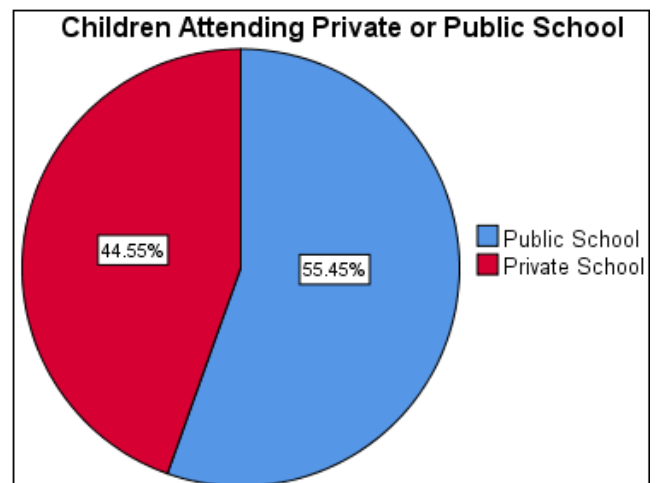

Figure 4.1: Type of School

4.2 Education Level of the Child

75.25% of all children in Kangemi are enrolled in primary school while 24.75% of children are enrolled in secondary school. These statistics are shown by Figure 4.2 below.
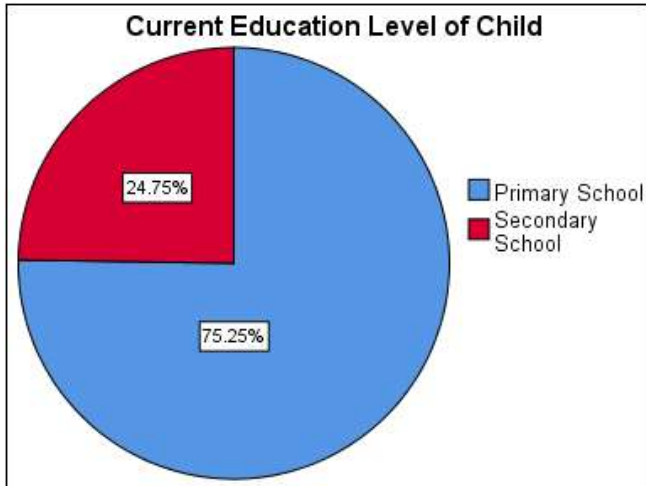
Figure 4.2: Current Education Level

4.3 Age of Parent

According to Figure 4.3 below, majority of parents in Kangemi who took part in the survey were aged between 26 and 33 at 52.48%, while the least represented by 6.93% were aged 50 years old and above. The rest of the minorities include parents in the age group 18-25 at 8.91%, 34-41 at 23.76% and finally ages 42-49 at 7.92%.
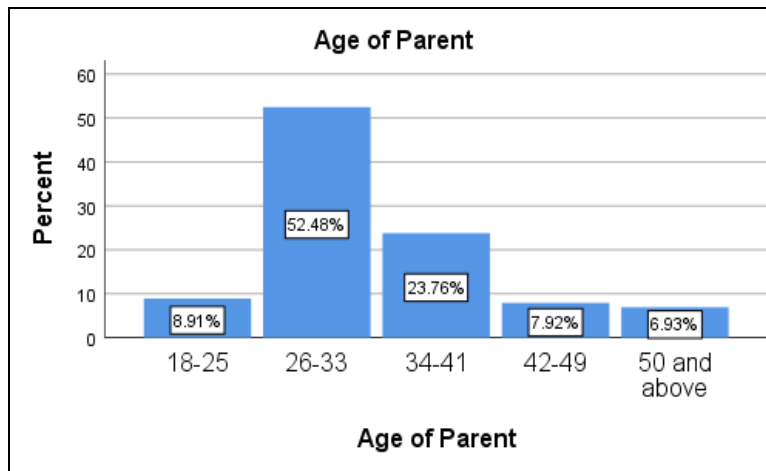

Figure 4.3: Age of Parent

4.4 Highest Education Level of Parent

More than half of the parents in Kangemi have had a maximum level of education of secondary school, at 54.46%, while 36.63% of parents have had a maximum level of education of only primary school. A mere 8.91% of parents have had a university or college education. These statistics are all depicted in Figure 4.4
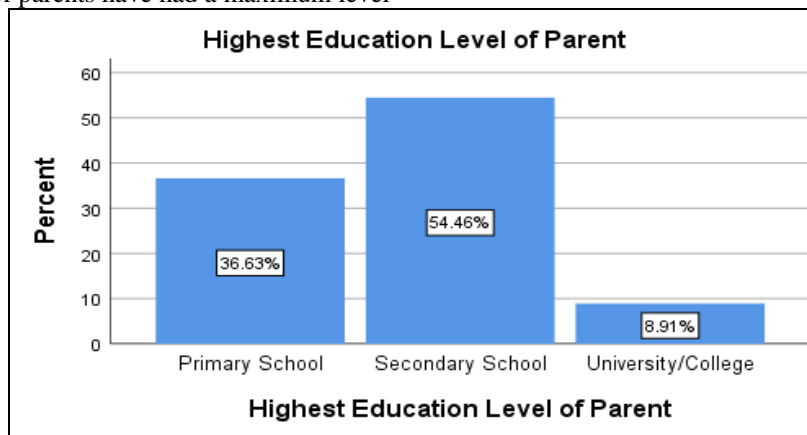

Figure 4.4: Highest Education Level of Parent

4.5 Parent's Monthly Income

Accroding to Figure 4.5, parents at Kangemi predominantly have an income of 11,000-20,000 with an overall percentage of 37.11%. Parents maximum earnings of 50,000 and above are at 2.06% and minimum earnings of 1000-10,000 are at 24.74%. In between this range, people with earnings of 21,000-30,000 are at 17.53% and those earning 41,000-50,000 per month are at 9.28%
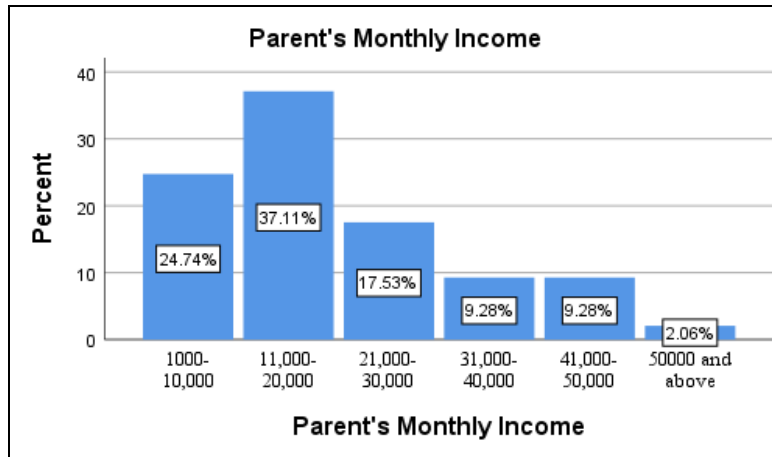
Figure 4.5: Parent's Monthly Income

4.6 Availability of Computers in School

Figure 4.6 depicts a large proportion of 61.39% of parents in Kangemi know that their children's school has computers available. 28.71% of children therefore do not have any access to computers, while 9.90% of parents did not know if their kids had access or not.
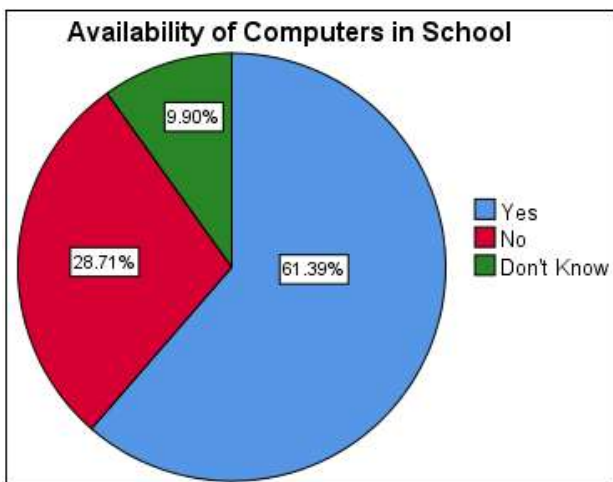

Figure 4.6: Availability of Computers in School

4.7 Child's Access to Computers in School

According to Figure 4.7, 41.58% of children in Kangemi did have access to computers within their school. However, 18.81% of the children did not have any access to computers in school.
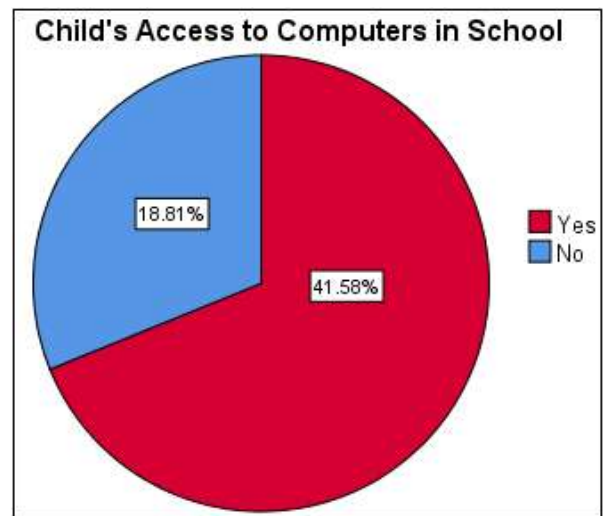

Figure 4.7: Access to Computers in School

4.8 Access to Computer at Home

Figure 4.8 shows that the majority of children in Kangemi do not have access to a computer at home, standing at 68.32%. a minority of 31.68% had access to a computer at home.
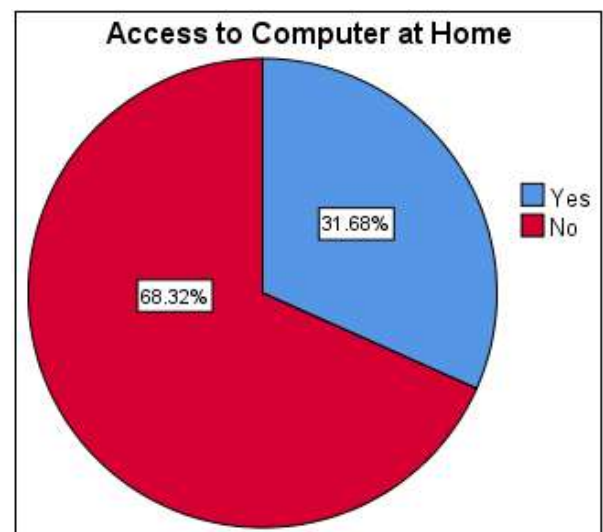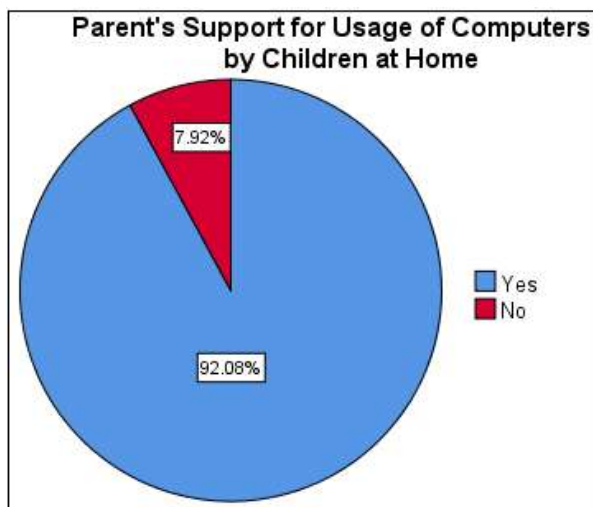

Figure 4.8: Access to Computer at Home

**4.9 Parent's Support for Usage of Computers by Children at Home**

Most parents, 92.08% of them, are in support of computers by supporting use of computers by their kids at home. A small minority of 7.92% are not in favour of this notion.

Figure 4.9: Parent's Support of Usage of Computers by Children at Home

4.10 Negative Effects of Using Computers at Home

As Figure 4.10 says, 51.49% of parents in Kangemi feel that there are no negative effects that arise due to usage of computers at home. 23.765% of parents feel that the biggest issue is access to illegal materials, 10.89% think that usage of computers at home would lead to addiction resulting in wastage of time and a further 10.89% believe that usage of computers leads to laziness.
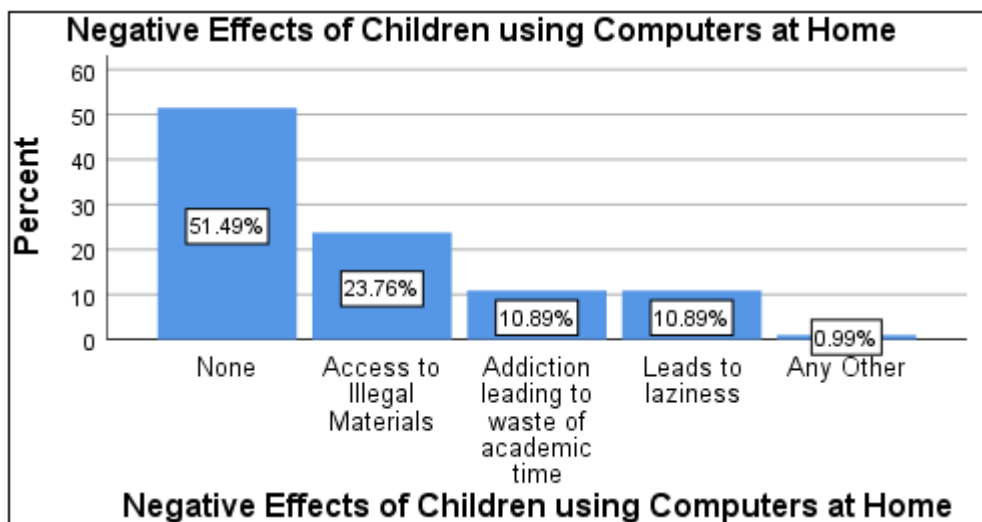
Figure 4.10: Negative Effects of Computers

4.11 Level of Reliability of Electricity Connection at Home

39.6% of parents in Kangemi said that their electricity connection at home is averagely reliable, while a similar percentage of 32.67% of parents said that their electricity connection was reliable to a small extent. 18.81% of parents mentioned that their electricity connection was very reliable while 7.92% of parents said that their electricity connection was not reliable at all. These statistics originate from Figure 4.11
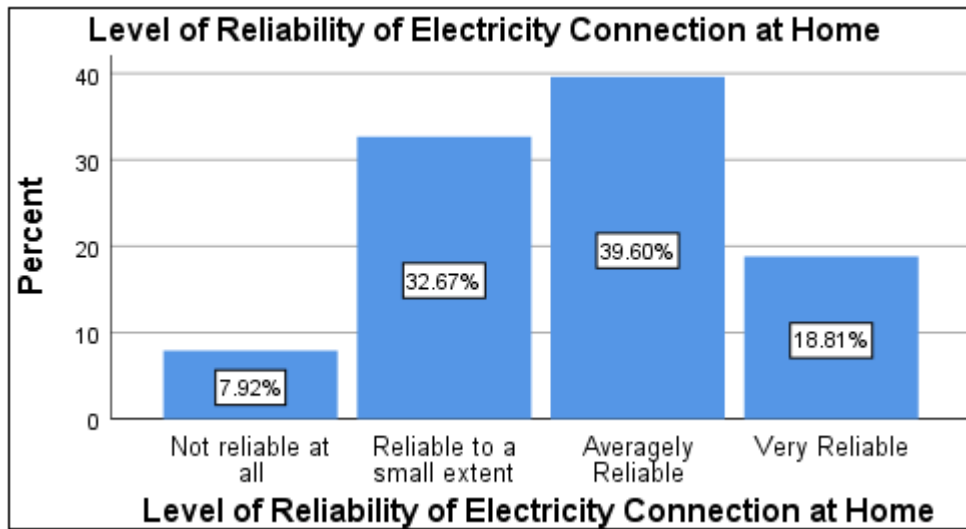
Figure 4.11: Reliability of Electricity at Home

4.12 Influence of Electricity on Cost on Provision of Computers at Home

According to figure 4.12, a grand majority of 69.31% of parents in Kangemi believe that electricity does not affect the provision of computers at home. A small minority of 28.71% believe that electricity does in fact play a role in determining the provision of computers at home.
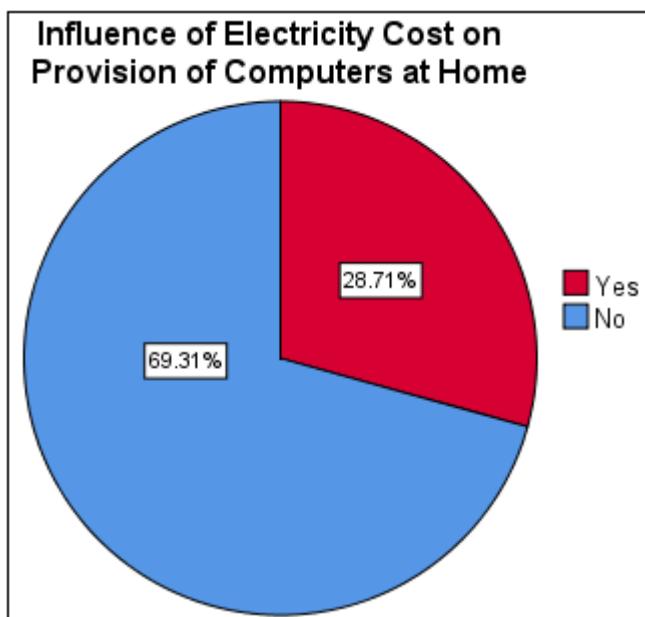
Figure 4.12: Cost of Electricity

4.13 Cost of Computers in Kenya

According to Figure 4.13, 70.30% of parents in Kangemi feel that Computers are too expensive in Kenya. A minority of 26.73% feel that Computers are not overpriced in Kenya.

Figure 4.13: Cost of Computers

4.14 Role of the Cost of Computers on Usage in Kangemi

As figure 4.14 depicts, a majority of parents in Kangemi at 30.69% believe the cost of computers plays a huge role, while 29.70% of parents feel that the cost plays a small role. 22.77% of parents believe that the cost of computers plays an average role, and a further 16.83% believe that the cost of computers plays no role.

Figure 4.14: Role of the Cost of Computers on Usage in Kangemi

4.15 If you had to pay Extra School Fees for your Child to have Access to Computers, would you do so?

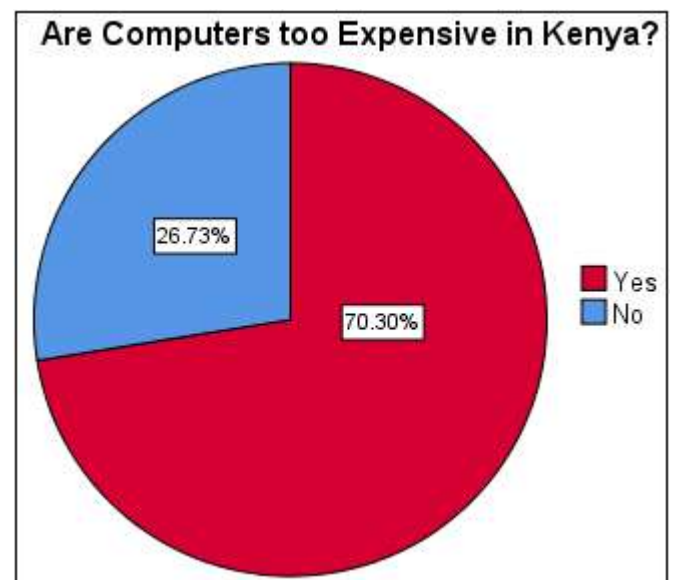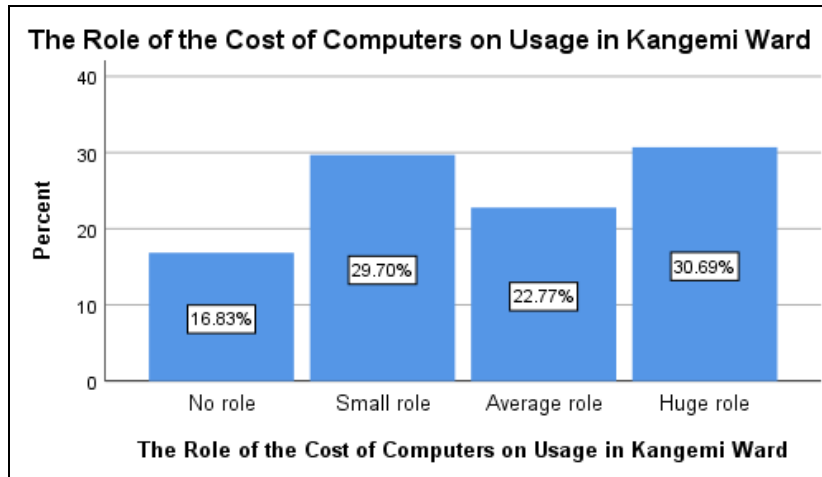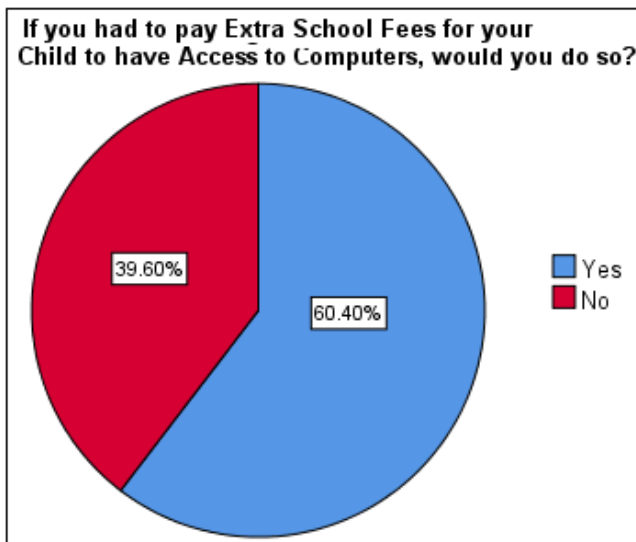As Figure 4.15 says, 60.40% of all parents in Kangemi would pay extra school fees in order for their children to have access to computers, while a minority of 39.60% would not pay extra school fees for their child.

4.16 Correlation Analysis of Type of School compared to Availability of Computers in School

From table 4.1 below we can decipher that the value of R^2 is 0.021 which is an extremely small value that nevertheless shows some form of linear relationship between the type of school children in Kangemi attend and availability of computers in the respective schools. There is a positive correlation between the type of school children in Kangemi attend and availability of computers throughout these schools.

Figure 4.15: Would Parents pay Extra School Fees?

Table 4.1: Correlation of School Type and Availability of Computers

					Change Statistics				
Model	R	R Square	Adjusted R Square	Std Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.144[a]	.021	.011	.669	.021	2.091	1	99	.151
a. Predictors: (Constant), Children attending Private or Public School									

Model Summary

Table 4.2: Correlation of School Type and Availability of Computers

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.765	.205		8.623	.000	1.359	2.171
	Children attending Private or Public School	-.194	.134	-.144	-1.446	.151	-.459	.072
a. Dependent Variable: Availability of Computers in School								

Coefficients[a]

Having established that there is a linear relationship between type of school and availability of computers. Table 4.2 below also shows that the p-value is 0.151 for children attending private or public schools. This value is above the normal significance level of 0.05. This means that regardless of a child in Kangemi being in Public or Private school, the availability of computers in these respective schools follows a similar pattern.

4.17 Correlation Analysis of Current Education Level of Child compared to Availability of Computers in School

From table 4.3 below one can see that the value of R^2 is 0.020 which is an extremely small value that still regardless shows some form of linear relationship between the current education level of the child and availability of computers in school. There is a positive correlation between the current education level of the child and availability of computers in school as depicted by Table 4.3 below.

Table 4.3: Correlation of current education level of child and availability of computers in school

Model Summary									
Model	R	R Square	Adjusted R Square	Std Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.142[a]	.020	.010	.669	.020	2.024	1	99	.158
a. Predictors: (Constant), Current Education Level of Child									

Having established that there is a linear relationship between the current education level of the child and availability of computers in school, according to table 4.4 below, the p-value is 0.158 for current education level of child. This value is above the normal significance level of 0.05. This means that regardless of a child in Kangemi being in Primary or Secondary school, the availability of computers in these respective schools follows a similar pattern.

Table 4.4: Correlation of current education level of child and availability of computers in school

Coefficients[a]							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	1.759	.204		8.637	.000	1.355	2.163
Current Education Level of Child	-.219	0.154	-.142	-1.423	.158	-.526	.087
a. Dependent Variable: Availability of Computers in School							

4.18 Correlation Analysis of Parent's Monthly Income compared to Access to Computers at Home

From table 4.5 below one can see that the value of R^2 is 0.259 which is an average value that shows a weak, yet significant linear relationship between parent's monthly income and access to computers at home by their school-going children. There is a strong positive correlation of 0.509 between parent's monthly income and their ability to provide computers for their school-going children at home.

Table 4.4: Correlation of parent's monthly income and access to computers at home

Model Summary									
Model	R	R Square	Adjusted R Square	Std Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.509[a]	0.259	0.251	0.406	0.259	33.167	1	95	0
a. Predictors: (Constant), Parent's Monthly Income									

Having established that there is a linear relationship between parent's monthly income and access to computers at home. According to table 4.6 below, the p-value is 0.000 for Parent's Monthly Income. This value is below the normal significance level of 0.05. This means that due to a parent's monthly income, their child's access to computers is affected.

Table 4.5: Correlation of parent's monthly income and access to computers at home

Coefficients[a]							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	2.126	.088		24.250	.000	1.192	2.300
Parent's Monthly Income	-.180	0.31	-.509	-5.759	.000	-.242	-.118
a. Dependent Variable: Access to Computer at Home							

4.19 Correlation Analysis of Level of Reliability of Electricity Connection at Home compared to Access to Computers at Home

From table 4.7 below, one can see that the value of R^2 is 0.288 which is an average value that shows a weak, yet significant linear relationship between level of reliability of electricity connection at home and access to computers at home. There is also a strong positive correlation of 0.537 between level of reliability of electricity connection at home and parents' provision of computers to their school-going children at home.

Table 4.6: Correlation of reliability of electricity connection at home compared to access to computers at home

Model Summary									
Model	R	R Square	Adjusted R Square	Std Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.537[a]	0.288	0.281	0.397	0.288	40.033	1	99	.000
a. Predictors: (Constant), Level of Reliability of Electricity Connection at Home									

Having established that there is a linear relationship between level of reliability of electricity connection at home and access to computers at home, according to table 4.8 below, the p-value is 0.000 for Level of Reliability of Electricity Connection at Home. This value is below the normal significance level of 0.05. This means that due to levels of reliability of electricity connection at home, access to computers at home is affected.

Table 4. 7: Correlation of reliability of electricity connection at home compared to access to computers at home

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	2.446	0.127		19.280	0	2.194	2.698
	The Role of the Cost of Computers on Usage in Kangemi Ward	-.284	0.045	-.537	-6.327		-.374	-.195
a. Dependent Variable: Access to Computer at Home								

4.20 Correlation Analysis between the cost of computers on usage in Kangemi, and access to computers at home

From table 4.9 below, one can see that the value of R^2 is 0.233 which is an average value that shows a rather weak, yet significant linear relationship between the cost of computers on usage in Kangemi, and access to computers at home. Table 4.9 further shows a strong positive correlation of 0.483 between the cost of computers in Kangemi and the parents' provision of computers to their school-going children at home.

Table 4.8: Correlation of cost of computers in Kenya and access to computers at home

Model Summary									
Model	R	R Square	Adjusted R Square	Std Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	.483[a]	0.233	0.225	0.412	0.233	30.092	1	99	.000
a. Predictors: (Constant), The Role of the Cost of Computers on Usage in Kangemi Ward									

Having established that there is a linear relationship between the cost of computers on usage in Kangemi, and access to computers at home, according to table 4.10 below, the p-value is 0.000 for the Role of the Cost of Computers on Usage in Kangemi Ward. This value is below the normal significance level of 0.05. This means that due to the cost of computers on usage at home, access to computers at home is affected.

Table 4.9: Correlation of cost of computers in Kenya and access to computers at home

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	1.128	0.109		10.336	0	0.912	1.345
	The Role of the Cost of Computers on Usage in Kangemi Ward	0.208	0.038	0.483	5.486		0.133	0.286
a. Dependent Variable: Access to Computer at Home								

4.21 Correlation Analysis for Type of School and Current Education Level of Child, compared to Availability of Computers in School

From table 4.11 below, one can see that the value of R^2 is 0.048 which is a very small value that regardless still shows a weak, yet significant linear relationship between type of school and current education level of child, compared to availability of computers in school. There is a positive correlation between the type of school a child attends and the current education level of the child. This correlation is fairly weak with a value of 0.218.

Table 4.10: Correlation of type of school and current education level of child

Model Summary				
Model	R	R Square	Adjusted R Square	Std Error of the Estimate
1	.218a	0.048	0.058	0.663
a. Predictors: (Constant), Current Education: Level of Child, Children Attending Private orr Public School				

As discussed above, there is a linear relationship between type of school and current education level of child, compared to availability of computers in school. According to table 4.12 below, the p-value is 0.095 for Children Attending Public or Private School in Kangemi Ward. There is also a p-value of 0.099 for Current Education Level of Child in Kangemi Ward. These values are above the normal significance level of 0.05. This means that going to public or private school and either having primary or secondary education affects availability of computers in school.

Table 4.11: Correlation of type of school and current education level of child

Coefficients^a							
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
1 (Constant)	2.133	.300		7.112	0	1.538	2.728
Children attending Private or Public School	-.226	0.134	-.168	-1.685	.095	-.492	.040
Current Education Level of Child	-.257	0.154	-.166	-1.665	.099	-.564	.049
a. Dependent Variable: Access to Computer in School							

5. Summary, Conclusions and Recommendations

5.1 Introduction

The goal of the study was to find out constraints of effective usage of ICT by students for learning in Kangemi Ward, Nairobi, Kenya. This chapter will elaborate a summary of the major findings, conclusions, recommendations and the suggestions for further research to address the gaps in this particular field of study.

5.2 Summary of Study

The study began by comparing different literature reviews about usage of ICT in education worldwide, then the focus was narrowed to ICT usage in Africa, and then finally in Kenya. This enabled the researcher to have a clear idea of the level of ICT used in education in other countries and the constraints faced by these respective countries. Furthermore, the researcher was able to fully understand the scope of ICT usage locally in Kenya. The main purpose of this study was to analyze the constraints faced by education systems in implementing ICT in education.

After literature review, a sampling procedure was determined, and implemented to create a survey. The scope this study was Kangemi Ward, Nairobi County, and the research tool that was designed for data collection was a questionnaire. Respondents were pre-qualified to be over 18 years of age, and residents of Kangemi Ward alongside the fact that they had to be parents with school-going children. Enumerators were hired to aid in the field data collection.

From the data collected from the field, the responses were inputted into IBM SPSS Software v.24 and analyzed. After the analysis was completed, the outcomes were presented in different formats to enable conclusions and recommendations to be drawn.

5.3 Conclusions

ICT is very important in education as it allows for children to become more innovative in their future lives. ICT gives students a more interactive setting that motivates them to do better and learn more. Globally, technology has revolutionized the way jobs function and in order for upcoming generations to adapt to these new settings, ICT is required in education to build a sense of familiarity.

Even though ICT is clearly needed in education, not every student has access to these technologies. Limitations to access to ICT may not be very prominent in first world countries, but in developing countries there are many constraints. Such constraints result in unequal distribution of technology. Kenya happens to be a developing country, and therefore faces difficulty in providing every student with ICT. However, it is notable that Kenya does have significant access to ICT, allowing for access of the same by a section of students.

Kenya is home to several slums. Kangemi is one of them. Constraints facing distribution of ICT in education is more apparent in slums as compared to other affluent parts of

Kenya. Even though slums are being constantly upgraded, the rate of uptake of ICT is still slow and gradual. This can be attributed to several factors.

5.3.1 Availability of Computers and the Extent of Usage in schools in Kangemi Ward, Nairobi Kenya.

As depicted in by Figure 4.6, a large proportion of 61.39% of parents in Kangemi know that their children's school has computers available. 28.71% of children therefore do not have any access to computers, while 9.90% of parents did not know if their kids had access or not. This shows that as much as many schools have computers, there is a substantial number of schools in Kangemi that do not have them. Furthermore, from figure 4.7, even in the schools that have computers in Kangemi, 18.81% of all students in the schools do not have access to the computers. Much as this is a small number, it is still significant since there is need for all students to have access to ICT in school.

There is a positive correlation between the type of school a child in Kangemi attends and the availability of computers in their schools. Since majority of the respondents had their children in public schools, the researcher can then posit that children in private schools in Kangemi have a higher chance of accessing and using computers at school.

5.3.2 Availability and Usage of computers at home in Kangemi Ward, Nairobi County.

According to Figure 4.8, most students in Kangemi did not have access to computers at their respective homes. 68.32% of all students did not have access to a computer, while a small percentage of 31.68% of all students had access to a computer at home. Much as this is the case, majority of parents at 92.08% do support usage of computers at home by their school-going children as supported by Figure 4.9. This means that there could be other factors that are resulting in the parents not being able to provide computers for their children at home.
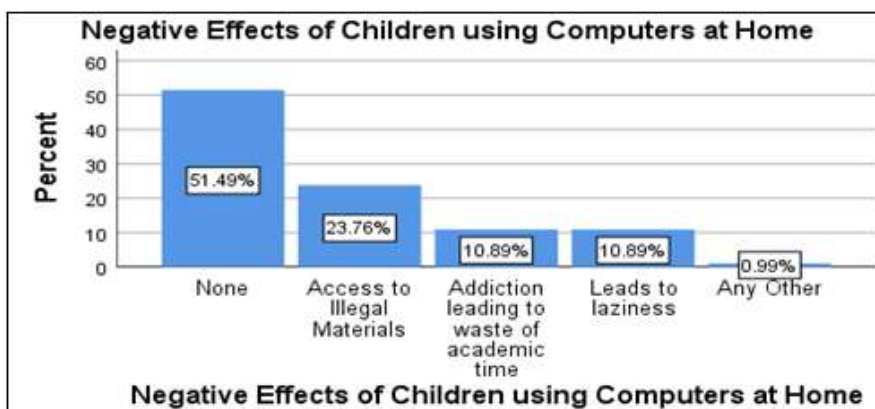

Figure 4.10: Negative Effects of Children Using Computers at Home

Even though parents support usage of computers at home by their school-going children, there are still some concerns raised over the negative effects computers can bring to their children as depicted by Figure 4.10. However, 51.49% of parents observed that there are no negative effects. There is also a positive correlation between the current education level of the school-going child and their access to computers at school. The import of this is that children in secondary school and primary school don't have equal chances of accessing and using computers for their education at school.

5.3.3 Effects of electricity availability and reliability on the provision and usage of computer by students in Kangemi ward, Nairobi County

In Kangemi, the levels of reliability of electricity differ. Parents mostly think of their electricity connection as averagely reliable as shown in Figure 4.11
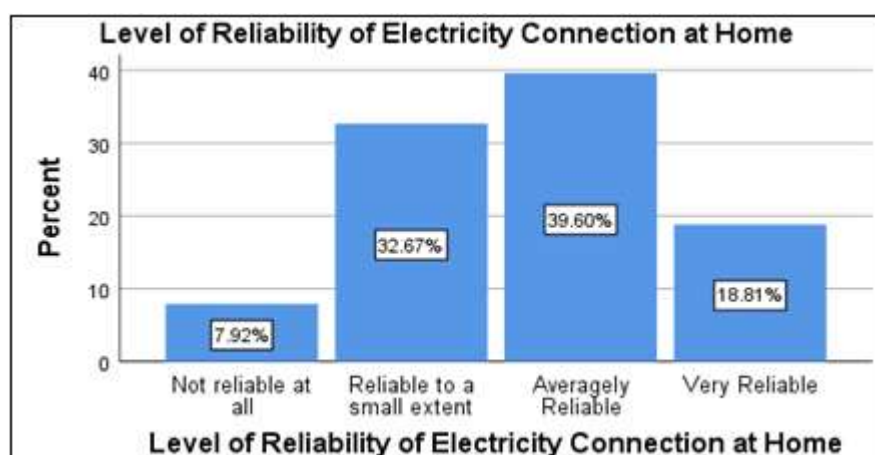
Figure 4.11: Level of Reliability of Electricity Connection at Home

Electricity also plays a role in provision and usage of computers by school-going children in Kangemi. Most parents observe that the cost of electricity does not play a huge role in provision of computers at home, a fact that is supported by the outcome in Figure 4.12. The general feeling is therefore, that electricity is not a big issue in the slums in relation to provision of computers to school-going children.

There is also an averagely strong positive correlation between the reliability of electricity connection at home and provision of computers by parents to their school-going children at home. This means that parents with very reliable electricity connections are more likely to provide computers for their children.

5.3.4 Effects of Cost of Computers on Provision to School-going Children in Kangemi

The cost of computers is a factor most residents of Kangemi attribute to the level of distribution of computers. As noted by Figure 4.13, 70.30% of parents in Kangemi said that computers were overpriced in Kenya, while a minority of

26.73% said that computers were not overpriced. A smaller minority of 2.97% did not know of prices of computers.

Due to their way of life, people from Kangemi view affordability of computers different than others living in affluent areas do. Most parents in Kangemi observed that prices of computers in Kenya play a huge role on the usage of computers, while a similar percentage of parents observed that prices of computers in Kenya played small and average roles. The general feeling therefore, is that cost of computers in Kenya does play a role in the usage of computers in Kangemi. These trends are shown by Figure 4.14.

There was an averagely strong positive correlation of 0.483 between cost of computers in Kangemi and the parents' provision of computers to their school-going children at home. This means that the cost of computers in Kangemi Ward is a determining factor for parents providing computers to their school-going children. Those who considered computers to be expensive were less likely to buy them for their children.
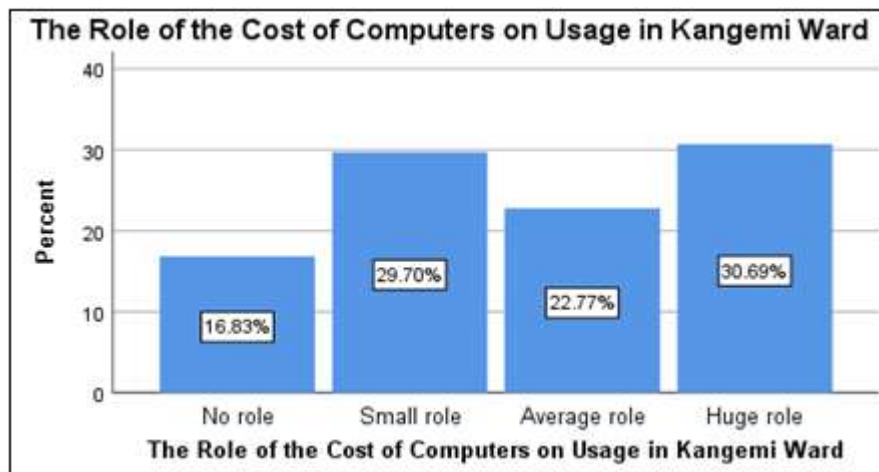
Figure 4.14: The Role of the Cost of Computers on Usage in Kangemi Ward

Parents mostly have full control over their child's education, and one aspect of this control is school fees. Most, if not all parents pay school fees in order for their kids to attend school. This school fees allows the school to purchase computers, and eventually results in the students gaining access. Majority of parents wish that their children have access to computers, and as Figure 4.15 shows, a majority of parents, at 60.40% would pay extra school fees in order for their kids to have guaranteed access to computers.

Access to computers at home is affected by cost of computers as discussed above, but is also affected by the incomes of parents in Kangemi who are providing these technologies. Table 4.4 shows the relationship between parent's monthly income and access to a computer at home. The correlation represented in Table 4.4 shows that there is a small, yet significant linear relationship between the two variables, which signifies that the access to computers at home is affected by the amount of money parents in Kangemi earn per month.

5.4 Recommendations

The researcher recommends the lowering of cost of computers in Kenya so that those living in slum areas such as Kangemi Ward, Nairobi County could afford them. This would ensure that more school-going children in slum areas such as Kangemi would have access to computers not only at school but also at home.

Secondly, cheaper and more reliable electricity connection in slums such as Kangemi could help increase provision of computers, as there were a percentage of people that acknowledged that reliability of their electricity connection was below average, as depicted in Figure 4.11. There were also a percentage of people that acknowledged that cost of electricity did play a role in their provision of computers, as shown in Figure 4.12

5.5 Future Scope

The importance of access and usage of computers by students in Kenya and especially in slums such as kangemi cannot be overemphasized. The future of many of school-

going children could be pegged on technology and especially by their usage of computers from an early age. For this reason, the researcher recommends that further researches on the same topic delve deeper on establishing solutions for constraint affecting provision of computers for children both at home and at school.

Further research needs to investigate the role of insecurity in provision of computers at home by residents of slum areas such as Kangemi, Nairobi County. This is because security is very paramount and computers happen to be valuable commodities that require safeguarding.

It would further be important to investigate the usage of other forms of ICT equipment in slum areas since it is not only computers that can add value to the quality of education offered in Kenya and specifically in slum areas such as Kangemi. Lastly, further research could also be done on the same analysis of computer coverage and usage in rural areas and compare it to urban areas.

References

[1] Adler, P.A. and Adler. P. (1987). Membership Roles in Field Research. Newbury Park, CA: Sage.

[2] Akonor K (2008). *Foreign Aid to Africa*: A Hollow Hope? International Law and Politics 40: 1071.

[3] Al-Ansari, H. (2006). Internet use by the faculty members of Kuwait University. *The Electronic Library* Vol**.**24, No. (6), Pp; 791-803.

[4] Ary, D., L. Jacobs, and A. Razavieh. (1996). Introduction to Research in Education. (5th ed.). Ft. Worth: Holt, Rinehart, and Winston, Inc.

[5] Communications Authority of Kenya (C.A.K) (2017). *Kenya's mobile penetration hits 88 per cent:* Communications Authority of Kenya.

[6] Cooper D.R., and Schindler P.S. (2001): Business Research Methods. New York. McGrawHill/Irwin, 2001.

[7] Daniels J.S. (2002) "Foreword" in Information and Communication Technology in Education–*A Curriculum for Schools and Programme for Teacher Development.* Paris:UNESCO.

[8] Ellsberg M, and Heise L. (2005). A Practical Guide for Researchers and Activists. Washington DC, United States: World Health Organization, PATH; 2005.

[9] FOLDOC - Computing Dictionary (2008): *Information and Communication Technology.* FOLDOC - Computing Dictionary, 19 September 2008.

[10] Goode, W.J., and Hatt, P.K., (1983). Methods in Social Research. Tokyo : McGraw – Hill International Book Co.

[11] Gunga, S. O.,and Ricketts, I. W (2006). Facing the Challenges of e-learning in African

[12] Universities *British Journal of Education Technology*. Malden, U.S.A: Blackwell Publishing Co

[13] Hedges, L.V. (2009). *Research methods.* Retrieved on 14th July 2013 from www.facultyprograms.org

[14] ICT Authority (2017). *Who We Are:* ICT Authority.

[15] ITU (2016): *ICT Facts and Figures 2016*: ITU

[16] Jhurreev, V. (2005)"Technology Integration in Education in Developing Countries: Guidelines to Policy Makers". *International Education Journal* [Electronic], 6(4):467-483.Available:

[17] *http://ehlt.flinders.edu.au/education/iej/articles/v6n4/jhurree/paper.pdf*

[18] Kabura, C. (2012): *ICT Development in Kenya*: What Role Has The State Played? Pp. 3

[19] Kothari, C.R. (2004). Research Methodology Methods & Techniques", Second Edition, New Delhi: New Age International publisher, 2004.

[20] Kozma, R. (2003) (ed.). *Technology, Innovation, and Educational Change: A Global Perspective*. Eugene: International Society for Technology in Education.

[21] Mugenda, M. (2006). *University Roles in Meeting Aspirations for ICT and Economic Development Frontier of Knowledge*. University Leaders' Forum. Cape Town, Nov. 19-26th 2006.

[22] Mugenda M.O.,& Mugenda G. A., (2003).*Research methods: Quantitative and qualitative approaches*. African Centre for Technology Studies (ACTS): Nairobi, Kenya

[23] Ogutu, J (2015). *How ICT Drives Kenya's Economic Growth:* The Standard, 18 May 2015.

[24] Okumbe, J. A. (2001). *Educational Management: Theory and Practice.* Nairobi: Nairobi University Press

[25] Pelgrum, W. J., Law, N. (2003) "ICT in Education around the World: Trends, Problems and Prospects"UNESCO-*International Institute for Educational Planning*. Available: *www.worldcatlibraries.org/wcpa/ow/02d077080fcf3210a19afeb4da09e526.html.*

[26] Prah KK (2002). *Culture, the Missing Link in Development Planning in Africa*. In Kwame K ed., Where Has Aid Taken Africa? Re-Thinking Development. Media Foundation for West Africa.

[27] Rodney W (1973). How *Europe Underdeveloped Africa*. Bogle-L'Ouverture Publications, London and Tanzanian Publishing House, Dar-Es-Salaam Online copy, http://www.blackherbals.com/walter_rodney.pdf (accessed October23, 2009)

[28] Statista (2017). *Number of monthly active Facebook users worldwide as of 1st quarter 2017*: Statista

[29] Statista (2017): *Snapchat - Statistics & Facts*: Statista

[30] UNESCO (2002) Information and Communication Technology in Education–*A Curriculum for Schools and Programme for Teacher Development*. Paris: UNESCO.

[31] UN Population Division. (2014). UN Population Division database. New York: UN Population Division. http://www.un.org/en/development/desa/population/

[32] Wainaina, E. (2016). *Kenya Government Plans Massive Roll-out of Laptops to Schools on September 1st*: Techweez ,13 August 2016.

[33] World Bank,(2004).*Contribution of ICTs on Economic Growth.* Washington D.C. The World

[34] Bank Institute.

[35] Yusuf, M.O. (2005). Information and communication education: Analyzing the Nigerian national policy for information technology. *International Education Journal* **Vol.** 6 No. (3), Pp; 316-321.

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